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Dry Creek Interceptor Wichita, Sedgwick, Kansas

(U.S.) Environmental Protection Agency, Kansas City, MO

May 79

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The Draft Environmental Impact Statement evaluates the environmental and monetary effects of replacing approximately 1700 linear feet of hydraulically overloaded and structurally deteriorated interceptor sewer. Impacts and associated mitigative measures are presented for five interceptor replacement alternatives.

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EPA

Environmental Impact Statement

Draft

Dry Creek Interceptor
Wichita, Sedgwick, Kansas

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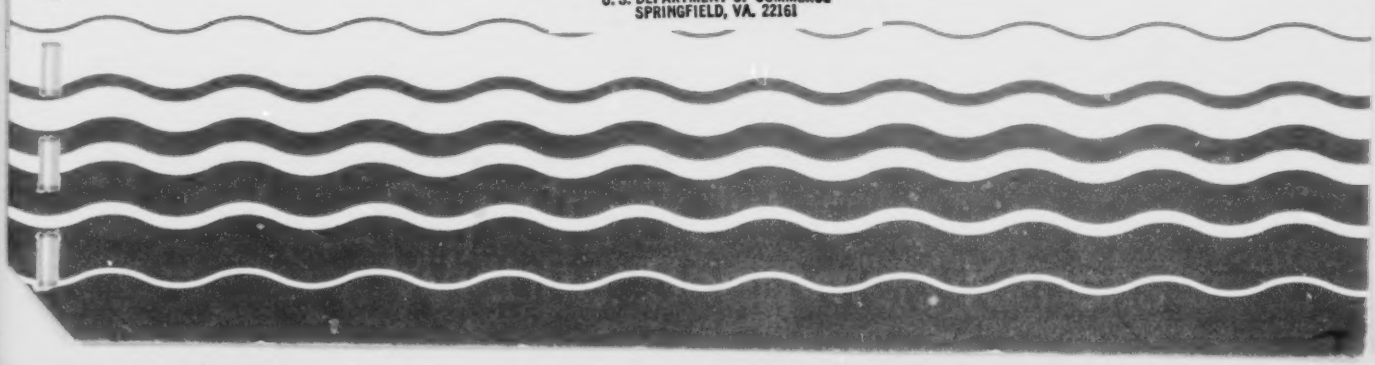

EPA-907/9-79-003

EPA-7-KS-Wichita - Sedgwick County - WWTP-79

DRAFT ENVIRONMENTAL IMPACT STATEMENT

For The Proposed

DRY CREEK INTERCEPTOR

in

WICHITA, SEDGWICK COUNTY, KANSAS

Prepared by

U.S. Environmental Protection Agency, Region VII

Kansas City, Missouri

Abstract: The Draft Environmental Impact Statement evaluates the environmental and monetary effects of replacing approximately 1700 linear feet of hydraulically overloaded and structurally deteriorated interceptor sewer. Impacts and associated mitigative measures are presented for five interceptor replacement alternatives.

Comments should be submitted to this office within 45 days of the date the EPA's Office of Federal Activities publishes notice of availability of the EIS in the Federal Register.

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APPROVED BY:

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Regional Administrator

ia

SUMMARY

DRY CREEK INTERCEPTOR:
WICHITA, KANSAS

(X) Draft ( ) Final

Responsible Office: U.S. Environmental Protection Agency, 324 East Eleventh Street, Kansas City, Missouri 64106, Telephone 816/374-2921.

1. Type of Action: (X) Administrative ( ) Legislative

2. Brief Description of Proposed Action: The subject action of this Environmental Impact Statement (EIS) is the award of construction grant funds for the design and construction of an interceptor sewer for the City of Wichita, Kansas, in accordance with Section 201 of the Federal Water Pollution Control Act of 1972 as amended (PL 92-500). The Environmental Protection Agency (EPA) has prepared this EIS to evaluate the impacts of replacing a portion of the Dry Creek Sanitary Sewer District Interceptor Sewer.

The project location is within the Dry Creek Sanitary Sewer District in Wichita, Sedgwick County, Kansas. Replacement of the interceptor sewer, as proposed by the City of Wichita, may impact a wooded area along Dry Creek which is valued for its aesthetic and biological attributes by the local residents. As a result of public objection and controversy over the proposed route, EPA further investigated the impacts of the City's proposed alternative and four additional wastewater transport alternatives and the no action alternative.

3. Alternatives: The following project alternatives are discussed in this statement:

a. Dry Creek: 1700 feet of 36-inch gravity sewer paralleling the existing Dry Creek sewer and 1200 feet of 24-inch sewer between Pawnee Avenue and Whitney Lane.

b. Mt. Vernon Gravity: 6600 feet of 36-inch gravity sewer constructed within the Mt. Vernon roadway from Bluff Street to Grove Street, and 1700 feet of 10-inch slip-liner in the existing Dry Creek interceptor.

c. Mt. Vernon Force Main: 6600 feet of 20-inch force main with an 8800 gallon-per-minute pump station, and 1700 feet of 10-inch slipliner in the existing Dry Creek sewer.

d. Bluff Gravity: 2300 feet of 36-inch gravity sewer located within the Bluff Street roadway south of Mt. Vernon and Kinkaid, west of Bluff and 1200 feet of 24-inch gravity sewer between Pawnee Avenue and Whitney Lane. This alternative also requires a 10-inch slipliner in the existing Dry Creek sewer.

e. Bluff Force Main: 2300 feet of 20-inch force main, with an 8800 gallon-per-minute pump station, located within the Bluff Street roadway, south of Mt. Vernon and Kinkaid, west of Bluff and 1200 feet of 24-inch gravity sewer between Pawnee Avenue and Whitney Lane. This alternative also requires a 10-inch slipliner in the existing Dry Creek sewer.

f. No Action: This alternative was dismissed as unfeasible because it would not eliminate the present hydraulic overloading of the Dry Creek sewer and eliminate sewage backups into some basements.

4. Environmental Impacts: Each of the feasible alternative transport techniques, is discussed in terms of its potential impact on the environment. Impacts considered are as follows:

a. Increased noise levels
b. Decreased property values
c. Increased urban development
d. Decreased aesthetic value
e. Disruption of a natural area and its associated wildlife
f. Increased stream erosion
g. Public safety hazard
h. Public inconvenience
i. Increased energy use

Agencies, organizations, and persons to whom copies of the statement were sent for review and comment:

Federal Agencies

U.S. Department of Agriculture
  Agricultural Stabilization and Conservation Service
  Soil Conservation Service
U.S. Department of Defense
  Army Corps of Engineers
U.S. Department of Health, Education and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of Interior
  Fish and Wildlife Service
  Geological Survey
  Heritage Conservation and Recreation Service
U.S. Department of Transportation
  Federal Highway Administration
Advisory Council on Historic Preservation

Members of Congress

Robert Dole, U.S. Senate
Nancy Kassebaum, U.S. Senate
Daniel Glickman, U.S. House of Representatives
Robert Whittaker, U.S. House of Representatives

State Agencies

Department of Agriculture
Department of Budget
Department of Health and Environment
Department of Transportation
Fish and Game Commission
State Biological Survey
State Geological Survey
State Historical Survey
State Park and Recreation Authority
Water Resources Board

State Representatives

Sandy Duncan, Kansas House of Representatives

Local and Regional

City of Wichita
- Mayor and Commission
- Community Development
- Water and Water Pollution Control Department
- Public Works Department
- Board of Park Commissioners
- Police Department
- Fire Department

Wichita-Sedgwick County
- Department of Community Health
- Metropolitan Area Planning Commission
- Environmental Advisory Board
- Citizens Participation Organization

Interested Groups

Kansas Wildlife Federation
Kansas Chapter Wildlife Federation
Audubon Society, Wichita Chapter
Sierra Club-Southwind Group
Izaak Walton League of America, Wichita Chapter
Friends of the Earth
Ks. Ornithological Society
Bird Populations Institute
National Wildlife Federation
Dry Creek Association
Archeological Association of South-Central Kansas
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Donald A. Distler, Ph.D.

Responsibility:	Provide, under contract to EPA Region VII, information on the biotic conditions in the Dry Creek area.
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Qualifications:	Education and experience in Terrestrial and Aquatic Ecology

Professional Engineering Consultants, 1440 East English, Wichita, Kansas

Responsibility:	Provide, under contract to EPA Region VII, information on engineering aspects of alternatives.
Qualifications:	Experience in the development of wastewater treatment project.

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CHAPTER I: PROJECT DESCRIPTION

Introduction

The City of Wichita, Kansas, has applied to the U.S. Environmental Protection Agency (EPA) for Federal financial assistance to improve wastewater treatment facilities within the city's Dry Creek Sewer District. This request for a grant is within the authority of EPA as defined in Section 201 of the Federal Water Pollution Control Act (FWPCA) as amended (PL 92-500). In reviewing this application, EPA must consider, not only the provisions of the FWPCA, but also the mandates of the National Environmental Policy Act (NEPA) of 1969. This law requires that all Federal agencies consider in their decision making process all potential environmental effects or impacts of their proposed actions, and make provisions either to avoid or to minimize the unavoidable adverse effects of the proposed action. NEPA further requires that all agencies of the Federal government prepare a detailed environmental impact statement (EIS) for projects that are deemed by the agency to have a significant impact on the quality of the human environment. The statement is a document which provides for public participation in the agencies' decision and, in the case of EPA, must follow specific regulations contained in 40 CFR, Part 6 as published in the Federal Register, Vol. 40, No. 72, April 14, 1975.

Issues

The wastewater facilities plan developed for the project proposed that a portion of the Dry Creek interceptor be replaced due to hydraulic overloading and structural deterioration of the existing interceptor (Figure 1). The portion identified as needing replacement is within a residential area bordering the Dry Creek urban wilderness. Substantial local opposition and controversy developed over the possible biological and aesthetic disruption of the area and decreased property values caused by construction-necessitated intrusion. Based on these considerations EPA decided that an EIS was needed.

Location

The total Dry Creek Basin project is located within the eastern portion of Wichita, Sedgwick County in south-central Kansas, and is concurrent with the Dry Creek Sanitary Sewer District boundary

(Figure 2). This district (one of 13 sewer districts operating within the corporate limits of Wichita), covers approximately 4.9 square miles, and is bordered on the north by 20th Street North, on the west by Hillside Avenue, on the south by George Washington Boulevard, and on the east by Woodlawn Avenue.

The area of specific concern within this total project area is the Dry Creek wooded area (Figure 1) in the vicinity of George Washington and Mt. Vernon Road.

History

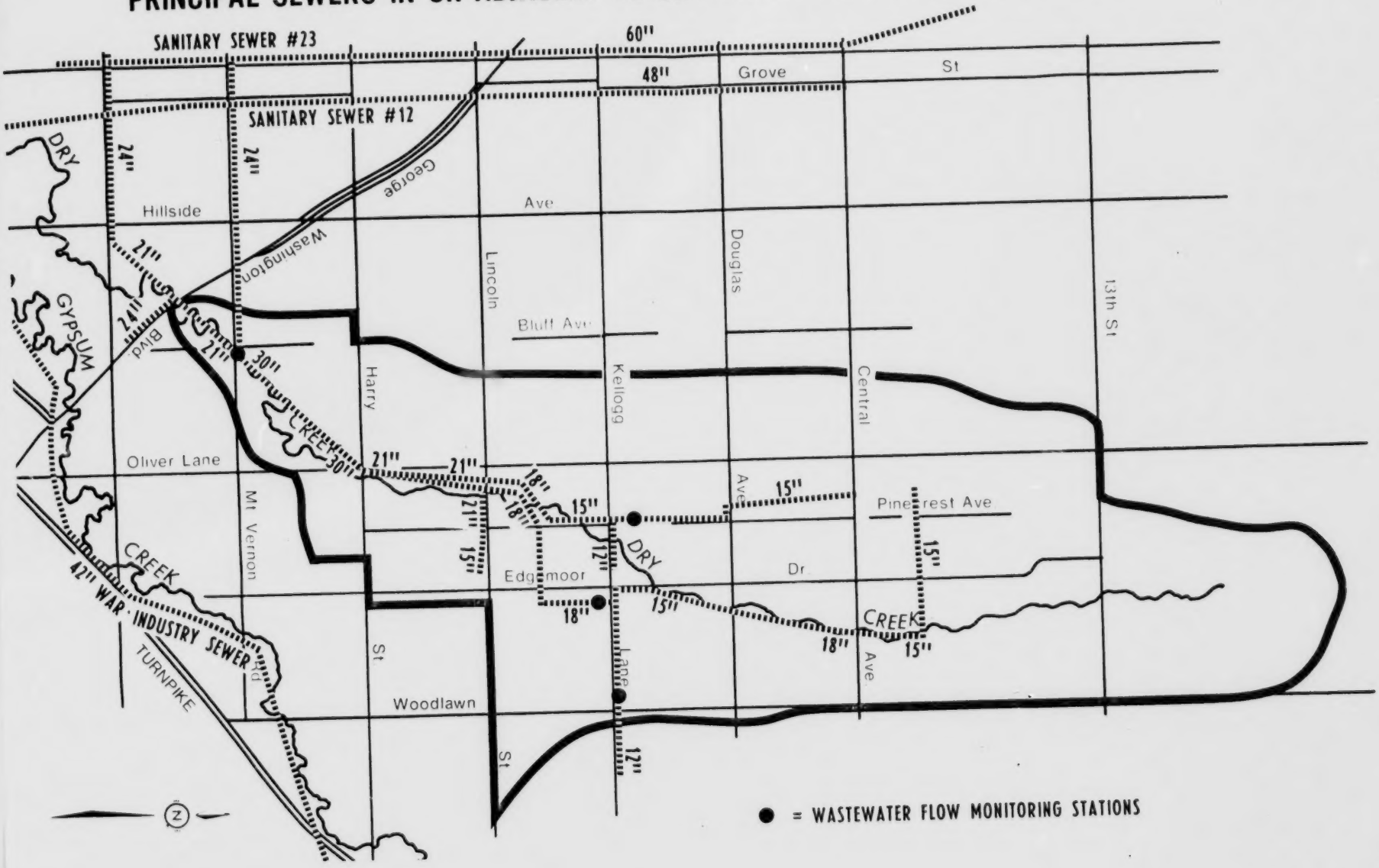
The Dry Creek interceptor project has been a subject of local Wichita concern for several years. "The Next Thirty Years" (1971), a sewerage facility plan for Wichita and Sedgwick County, rated replacement of the Dry Creek interceptor as the second priority in the implementation of this plan. The rationale used in assigning this priority included the fact that the present interceptor was hydraulically overloaded and had structurally deteriorated due to age.

In May 1974, the City of Wichita made a preliminary application to EPA for grant assistance to construct a portion of the Dry Creek interceptor within the George Washington right-of-way. This request was denied by EPA because an engineering report and construction plans and specifications were not available for review. The City of Wichita constructed this portion of the interceptor without Federal funding (Figure 1).

In August 1977, a grant application was received by EPA for Federal funding to complete the rehabilitation of the remaining portion of the Dry Creek interceptor. On September 12, 1977, the facilities plan for this project was approved and an Environmental Impact Appraisal and a Negative Declaration were issued. The formal grant award for construction was made on September 30, 1977, and accepted by the City of Wichita on October 24, 1977. Subsequently, final construction plans and specifications were approved on February 27, 1978. However, when public controversy developed over potential destruction of the Dry Creek wooded area, both the Environmental Impact Appraisal and the Negative Declaration were reevaluated. Subsequently, on July 26, 1978, EPA rescinded the Negative Declaration and issued a Notice of Intent to prepare an EIS on the proposed project.

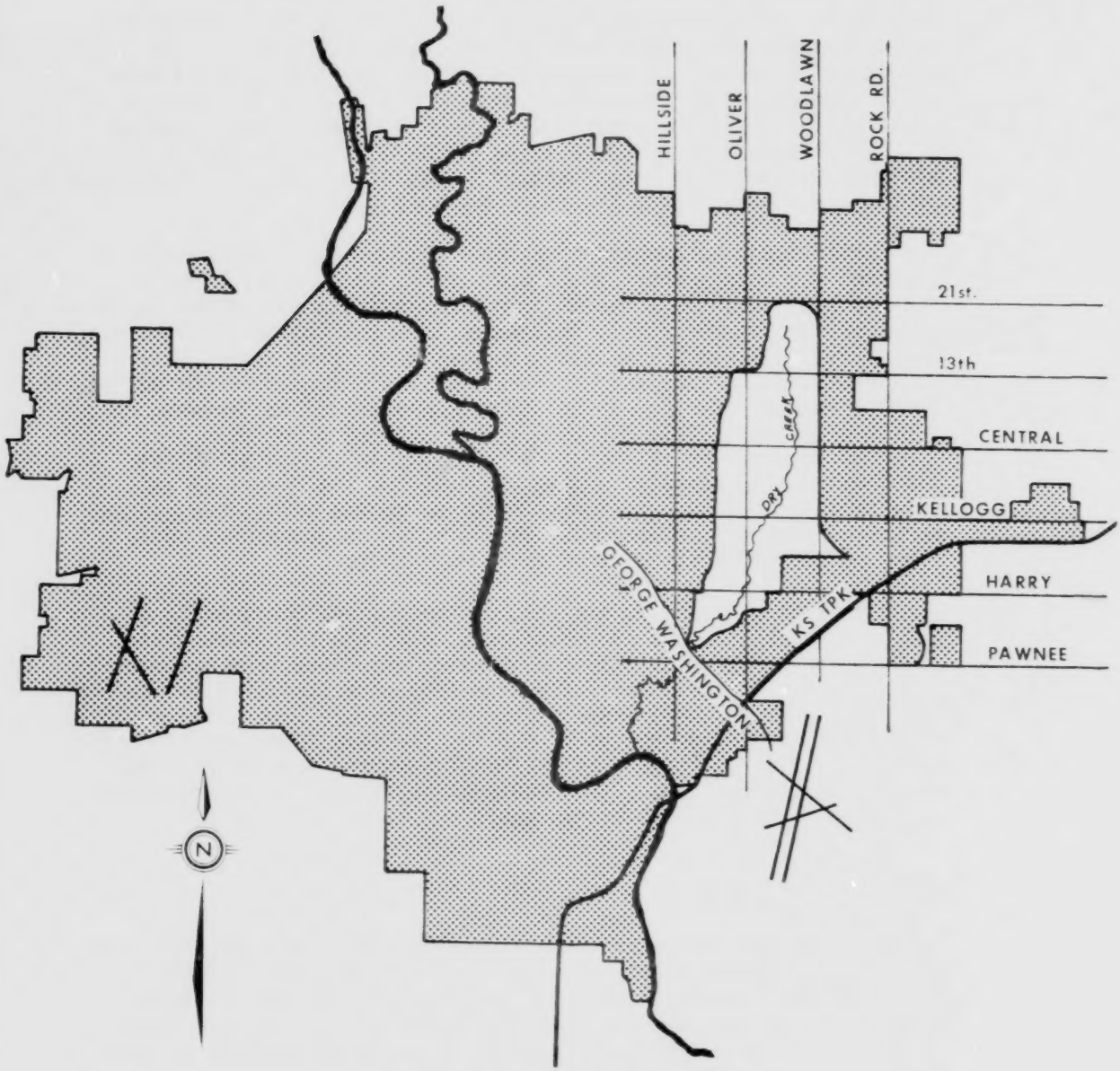
Figure 1

PRINCIPAL SEWERS IN OR ADJACENT TO DRY CREEK SANITARY SEWER DISTRICT



LOCATION OF DRY CREEK SANITARY SEWER DISTRICT

Figure 2



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Present Interceptor Conditions

All wastewater flows which originate in the Dry Creek basin enter a diversion manhole at Mt. Vernon and Bluff Street. At this manhole 70 percent of the average daily flow and 85 percent of the peak daily flow enters the existing 21-inch Dry Creek interceptor and ultimately discharges into Sanitary Sewers 12 and 23. The remaining 30 percent of average daily flow and 15 percent of peak daily flow are diverted to an extension of a 24-inch interceptor sewer which serves the eastern portion of Sanitary Sewer District 12. This 24-inch interceptor flows westerly along Mt. Vernon and ultimately discharges into Sanitary Sewers 12 and 23. The locations of these Sanitary Sewers are indicated in Figure 1.

The facilities plan and infiltration/inflow analysis which were prepared for this project found that the existing sewer system did not have sufficient capacity to transport the peak flows which developed in the district. Wastewater flow monitoring within the basin (Figure 1) indicates that the peak flow rates, due solely to sanitary waste, are approximately 3.9 million gallons per day (MGD). However, during periods of wet weather, flows increase to a rate of approximately 12.6 MGD. This rate of flow could be expected to occur on an average of once every two years. Since the flow routing capacity of the system below the diversion manhole is only 6.6 MGD, wastewater backs up to the collection system during periods of wet weather. This results in wastewater overflows in the basements of some basin residences.

Based on a cost-effective analysis of the options of removing 6 MGD of extraneous flows by rehabilitation of the Dry Creek Basin sewer system or transporting and treating all flows from the basin, it was determined that increasing the pipe capacity below Mt. Vernon and Bluff and rerouting these flows from Sanitary Sewers 12 and 23 to another sewer referred to as the War Industry Sewer was the most cost-effective solution. The estimated cost for removal of 6 MGD of extraneous flows was $1,759,000 compared with an estimated total capital cost of $755,090 to transport and treat all 12.6 MGD.

Public Participation

To better define the major issues associated with this project, EPA held a public meeting early in the EIS planning process (October 4, 1978), in the planning area. Approximately 75 citizens attended. As a result of this meeting, the EIS impact analysis was re-directed in some cases, and increased in other cases, in an attempt to make the EIS more responsive to public concerns.

CHAPTER II: ENVIRONMENTAL SETTING

Climate

Wichita's location near the geographic center of the United States results in a generally modified continental climate. Warm, moist air masses originating in the Gulf of Mexico predominate in the summer, while cold, dry artic air masses predominate in the winter. Alternate passage and overrunning of air masses in all seasons create a local climate subject to abrupt changes.

The mean annual precipitation as measured at Wichita's Mid-Continental Airport is 24.47 inches (NOAA 1963-1977). Most of the precipitation occurs as rain during the spring. Typical monthly rainfall distribution is shown in Figure 3.

Summers are usually hot with southerly winds, while winters are relatively mild. Snow flurries are common but extended periods of snow cover are uncommon. Monthly temperature distribution for the years 1963-1977 is shown in Figure 4.

Topography

The topography of the study area is level to rolling. Altitudes range from a high of 1400 feet in the northeast to a low of 1280 feet in the south.

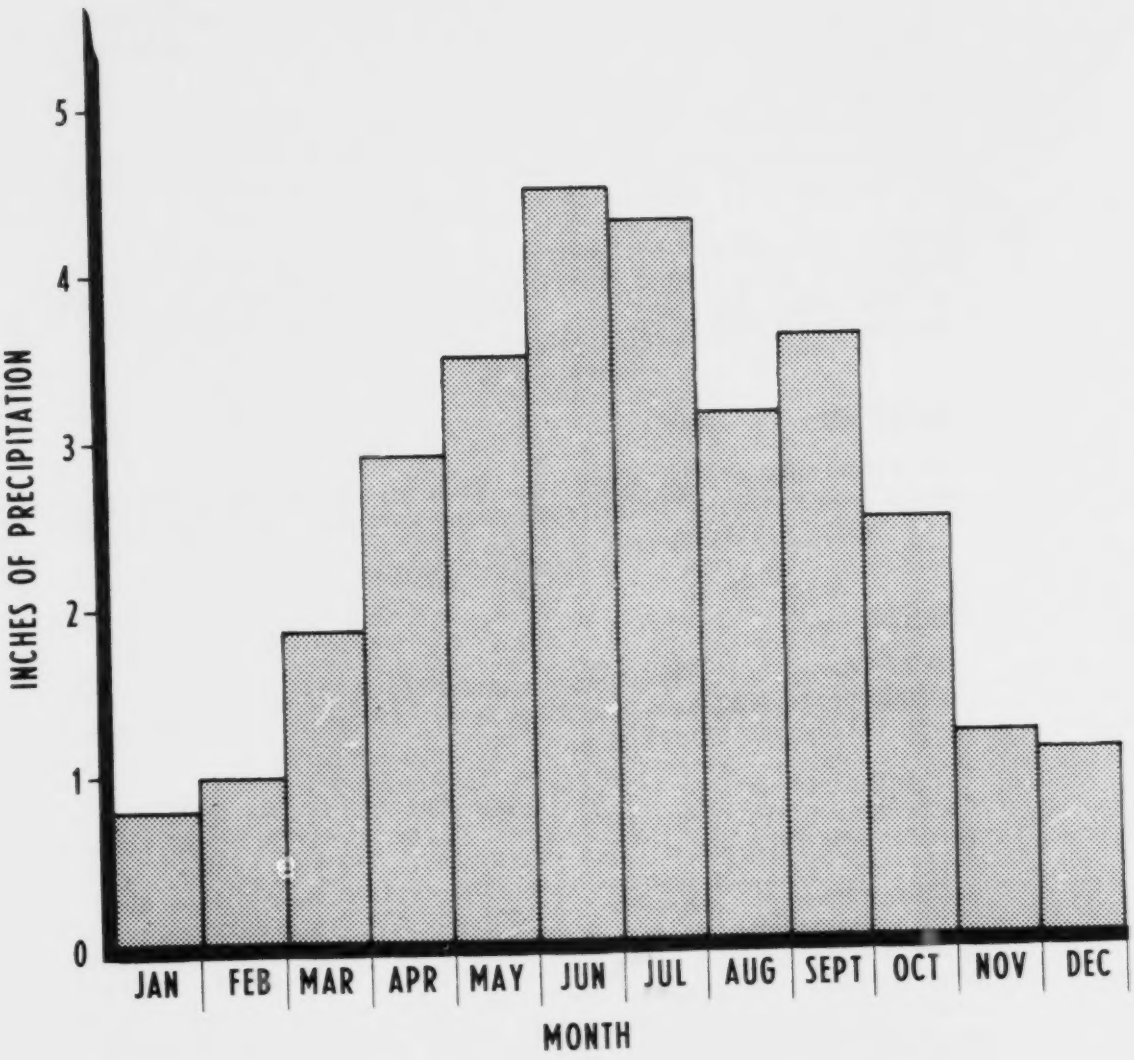
Geology

The Dry Creek Basin is located within the Wellington Shale Uplands geological area and immediately adjacent to the Arkansas River Valley geological area.

The principal unit of the Wellington Uplands is the Wellington Formation. This formation is part of the summer group of Lower Permian age (250-300 million years old). The Wellington Formation forms the bedrock under the eastern four-fifths of Sedgwick County, an area which includes the Dry Creek Basin. Within the county, depths of the Wellington Formation vary from surface outcroppings to depths of approximately 550 feet below land surface. Within the Dry Creek Basin, the Wellington Formation does not outcrop and is generally more than 30 feet below land surface.

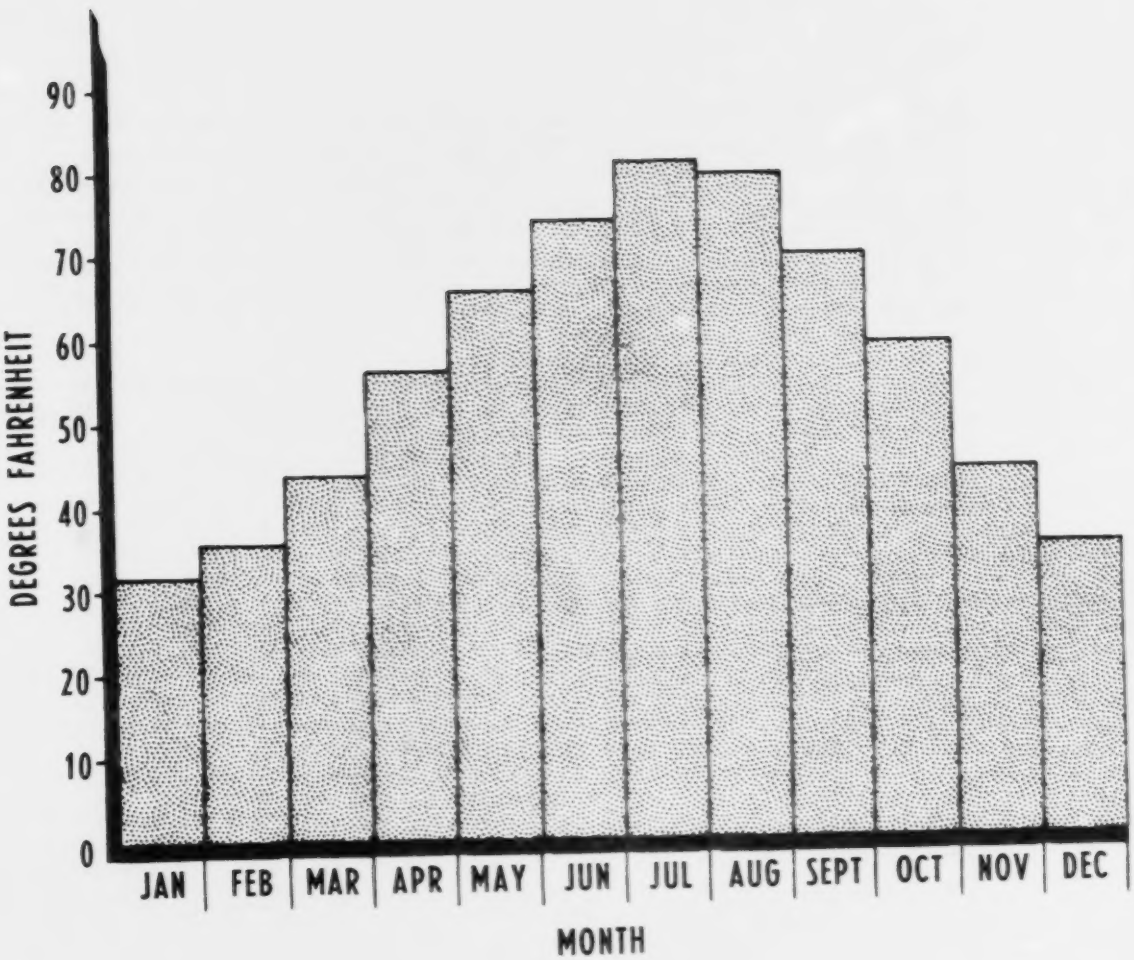
MONTHLY RAINFALL DISTRIBUTION

Figure 3



MONTHLY TEMPERATURE DISTRIBUTION

Figure 4



The Wellington Formation is chiefly composed of calcareous gray and blue group shales. Additionally, thin beds or layers of impure limestone, gypsum, and salts are present in some areas. Solution of these beds and physical weathering of the shales have generally caused gentle undulating topography of the study area.

Within the Dry Creek Basin the Wellington Formation is principally overlain with calcareous silts, and clay with scattered lenses of sandy silts. The silts and clays are primarily loessial (wind-deposited) and secondarily the result of weathering and subsequent deposition of the Wellington Formation. The occasional sandy silt and clay lenses are the result of minor historic variations in this area within the Arkansas River Valley.

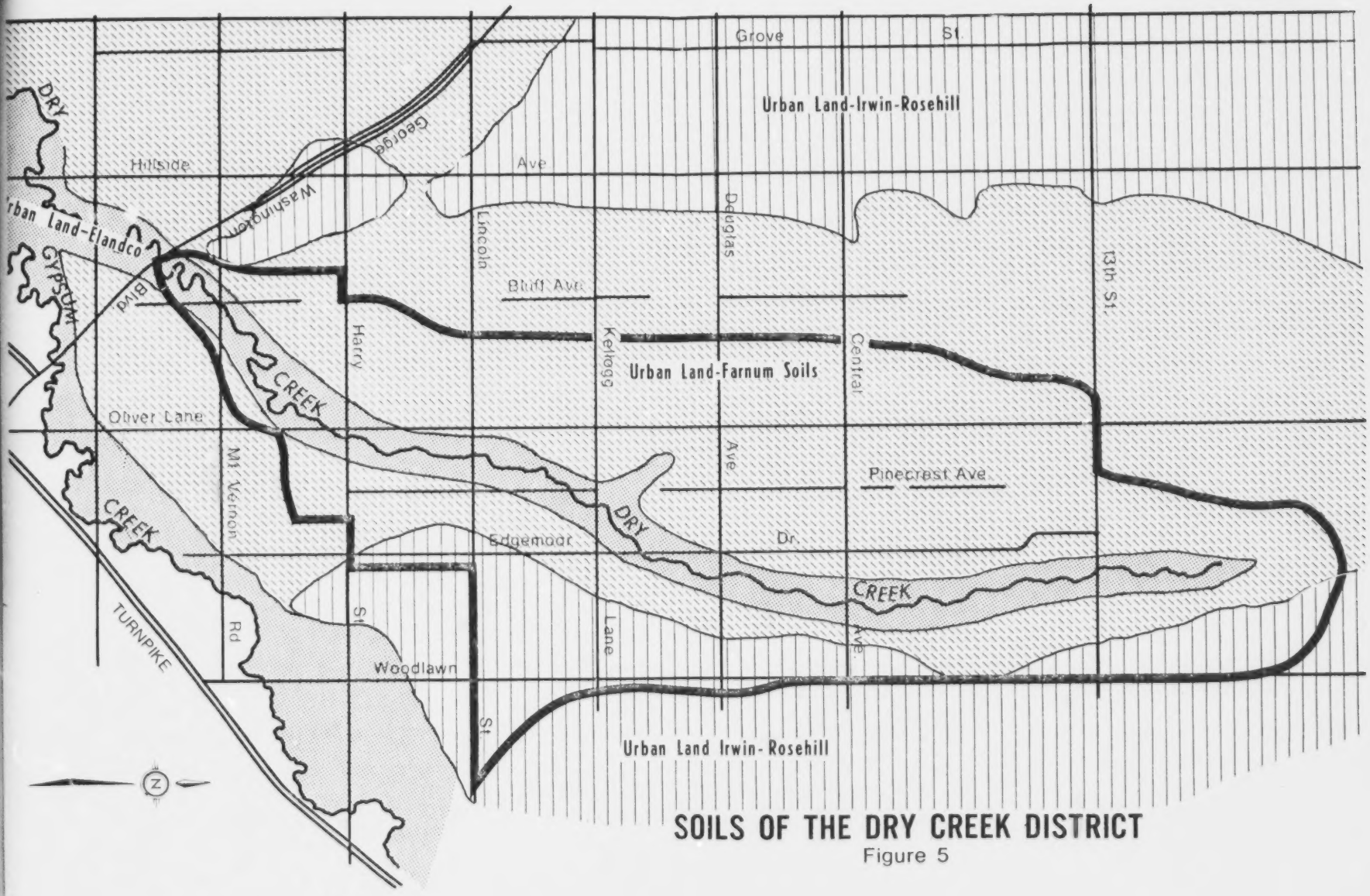
Soil

Within the Dry Creek Basin, three soil units are present: The Urban land-Elandco Complex, the Urban land-Farnum Complex, and the Urban land-Irwin-Rosehill Complex (Penner 1978). The location and areal extent of these units can be seen in Figure 5. Although general series characteristics can be applied to basin soils, urban construction activities such as the placement of fill material have resulted in numerous locations where the general series soil characteristics do not apply.

Soils of the Urban land-Elandco Complex are the principal soils within the impact area, and are located in the floodplains. These soils are silty clay loams of fine particle size and are the result of alluvial processes. Although located within floodplains, these soils are well-drained, permeable, and have slow runoff characteristics. The erosion factor of 0.37-0.43 places these soils in the moderate erosion potential range. However, due to their permeability and drainage, annual sediment yield from both sheet and gully erosion is low.

The Urban land-Farnum Complex are upland soils of level to slightly sloping topography. These soils are sandy clay loam of moderate particle size. Storm water runoff is slow to medium and erodibility is low to moderate for these soils.

The Urban land-Irwin-Rosehill Complex are fine-grained silty clays probably derived from weathering and erosion of the local bedrock, the Wellington Formation, and the deposition of loess. These soils are located on upland slopes of three to eight percent. Soils of



SOILS OF THE DRY CREEK DISTRICT

Figure 5

this complex exhibit moderate to rapid storm water runoff depending on the land slope. Similar to the Urban land-Elandco Complex, these soils are moderately erodible with an erosion factor of 0.37 to 0.43.

Groundwater: Quantity and Quality

Within the Dry Creek Basin static groundwater elevation is generally encountered at depths greater than 25 feet below land surface. The water table level generally exists at the interface of the soil overburden and the Wellington Formation. Movement along this interface is southwesterly toward the alluvial material of the Arkansas River. The quantity of water at this interface is low. Waters taken from wells which penetrate the Wellington Formation tend to be quite hard with a high sulfate concentration. Within the impact area, a series of test borings failed to encounter a static groundwater table at depths of 30 feet below land surface. Some seepage water which was encountered in test borings was probably transmitted through thin sand lenses with greater permeability than the surrounding soils (Allied Laboratories 1978).

Surface Water Quantity and Quality

Streamflow characteristics of Dry Creek are the result of the interaction of three important parameters: Geological conditions (depth to groundwater, soil type), climatic conditions (seasonal rainfall distribution, rainfall intensity), and land use characteristics. Local and regional geological conditions affect the flow of Dry Creek by determining the base flow (flow which results from groundwater entering the creek). Since depth to groundwater in the Dry Creek area is in excess of 25 feet, the base flow of Dry Creek is nearly nonexistent. Information developed by the Kansas Water Resources Board (Furness, Burns and Busby 1966) indicates base flow for the area is about 0.0075 cubic feet per second (cfs) per square mile of drainage basin. For Dry Creek this would amount to about 0.0375 cfs, or the amount of water consumed per day by 70 households.

Two partial-record streamflow and rainfall recording stations are located within the Dry Creek Basin (Figure 6). The U.S. Geological Survey Station 07144330 at Lincoln Street has been operated since March 1964, and the City of Wichita Station 07144340 at Pawnee Avenue has been in operation since March 1971.

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The urbanized nature of the Dry Creek Basin (approximately 30 percent or 1.5 square miles of impervious surface according to Peek and Jordan 1978), channel modifications, and storm sewer construction have contributed to peak period of streamflow occurring early in a storm water runoff event. Additionally, these factors have contributed to increases in both volume and peak runoff rate. The rapid response of the Dry Creek drainage system to intensive rainfall has resulted in many areas having drainage problems or being within the 100-year flood hazard area (Figure 6).

Information on historic trends in surface water quality in the Dry Creek Basin is not available. Data collected on September 14, 1978, from Dry Creek represents the only known information on surface water quality (Table I). While this information is not complete enough to make definitive comments on water quality, the elevated levels of plant nutrients (nitrates and orthophosphates), turbidity, and depressed levels of dissolved oxygen (DO) indicate that Dry Creek is subject to some type of pollution loading. Considering the relationship between rainfall runoff, streamflow, and water quality data, the pollution source is probably due to urban nonpoint runoff.

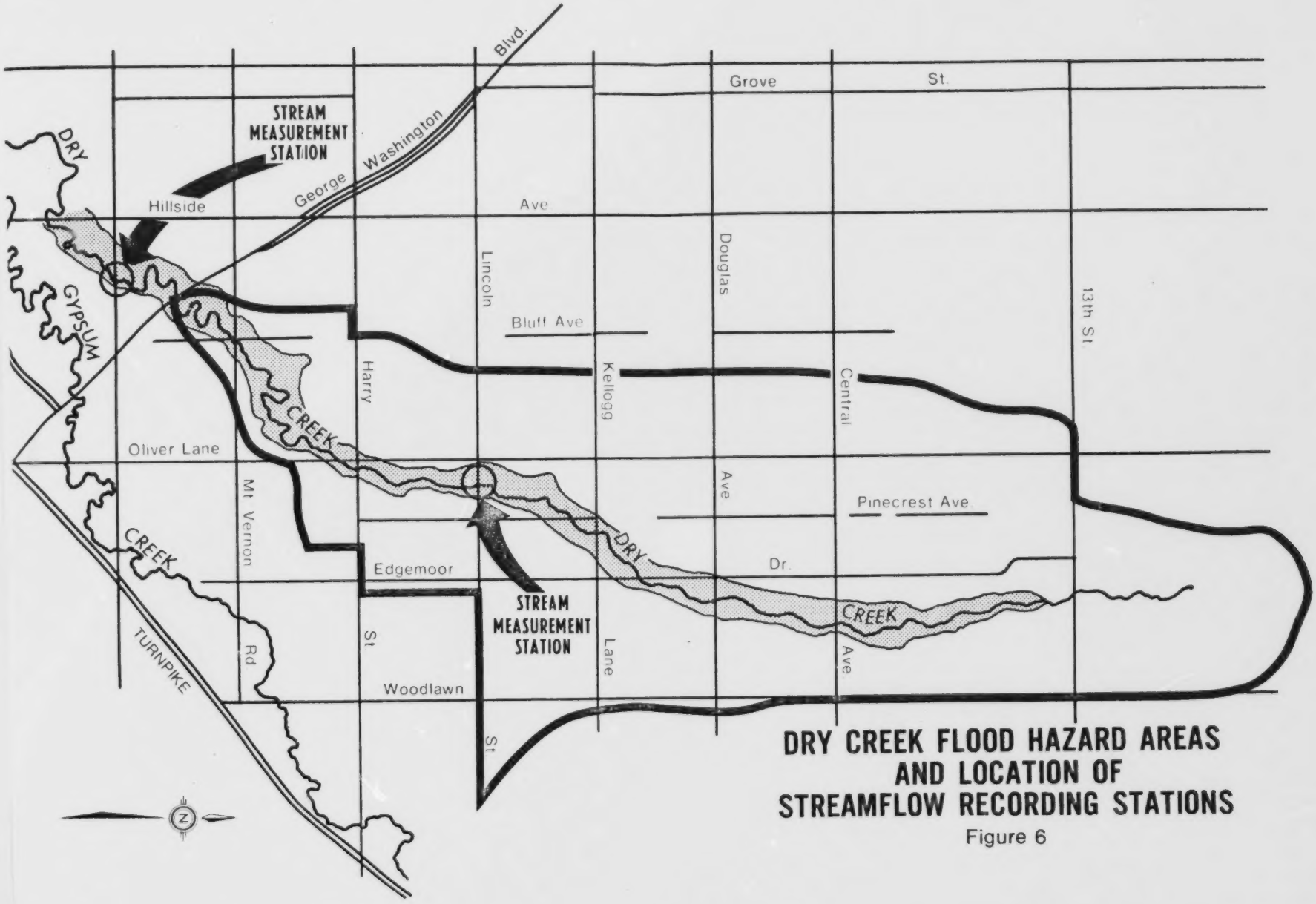
Air Quality

Air quality data for the Dry Creek Basin are available from the air quality monitoring station located adjacent to the basin at Fire Station Number 11, 1845 George Washington Boulevard. Based on sampling data (Figure 7), annual mean values for three pollutants (nitrous oxides, sulfur dioxides, and particulates) during 1975, 1976, and 1977 were not in violation of air quality standards.

Land Use

Within the Dry Creek Basin, the principal land use is residential consisting of single or multi-family dwelling units. A house count, based on aerial photos at a scale of 1 inch = 200 feet, indicated that approximately 6,300 single family dwelling units, and 2,800 multi-family dwelling units are located within the basin. This is a density of approximately 1,860 units per square mile (Dry Creek Sanitary Sewer System Facilities Plan 1977).

Additional land use is associated with retail, commercial, and service enterprises that provide necessary services to area



DRY CREEK FLOOD HAZARD AREAS AND LOCATION OF STREAMFLOW RECORDING STATIONS

Figure 6

Table I: Water Quality of Dry Creek

Parameter	Concentration *
Alkalinity	115
Chlorides	16
Total Hardness	110
Nitrates	6
Orth-phosphates	0.7
Sulfates	20
Dissolved Oxygen	3
Turbidity	55
pH	8.6

* All values in parts per million except Turbidity (Jackson Turbidity Units) and pH (pH Units).

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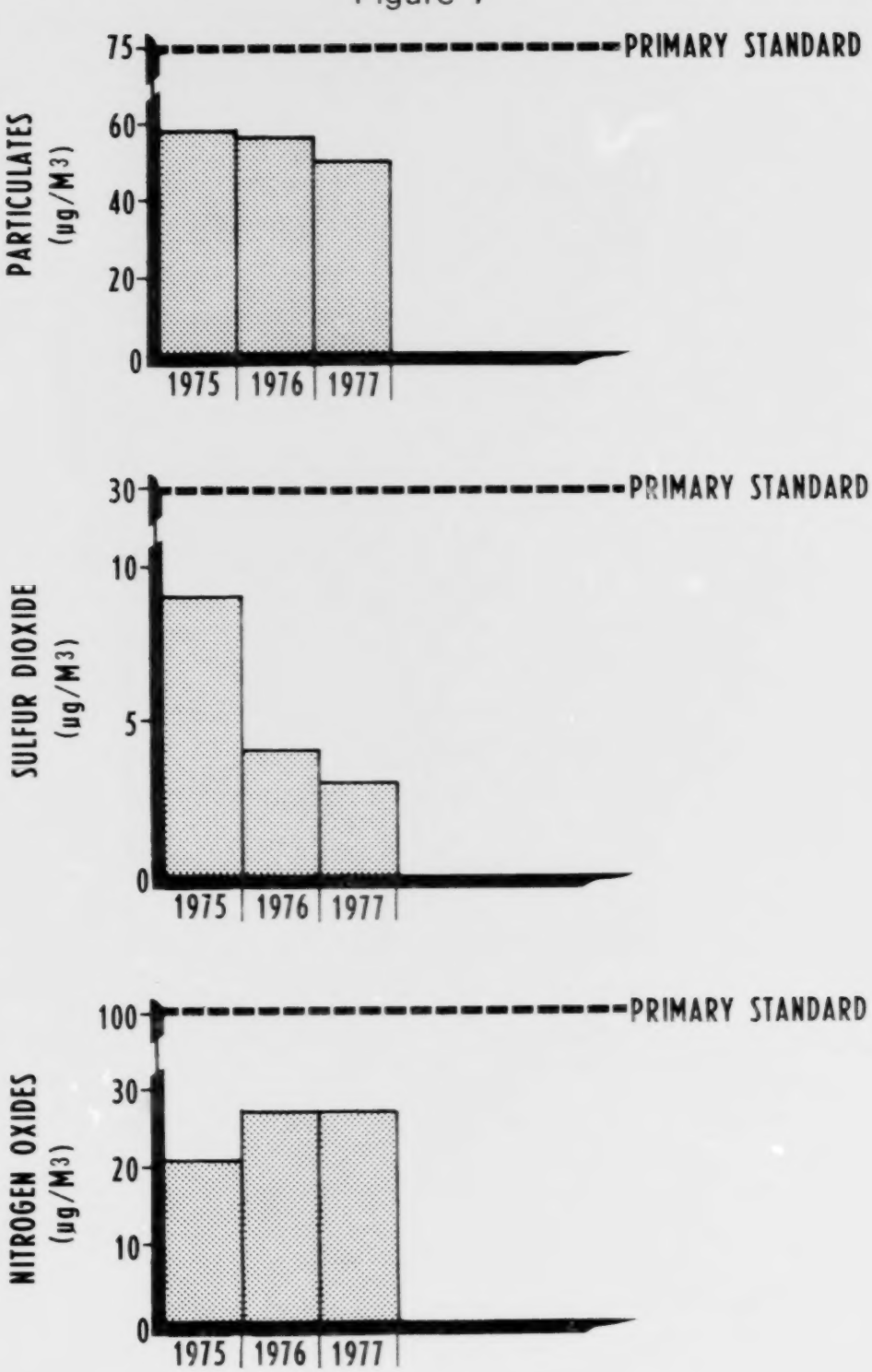
AIR QUALITY

Figure 7



residents. These enterprises are mostly located as strip development along arterial streets. There are no areas of concentrated industrial development. This present pattern of land use is expected to continue. Internal development in all probability would not convert present residential areas to other uses, but rather would minimize urban sprawl through full utilization of the existing infrastructures (Wichita-Sedgwick County Planning Commission Personal Communication).

Population

The Dry Creek Basin had an estimated 1976 population of approximately 18,500 (Wichita-Sedgwick County Land Use Plan 1977). This figure represents about seven percent of the city's population. The basin is expected to exhibit a relatively moderate population growth rate, increasing by about eight percent to 20,050 by the year 2000. This growth is not expected to occur uniformly but rather will occur where vacant or undeveloped land parcels presently exist. The general location of these growth areas is shown in Figure 8.

Employment

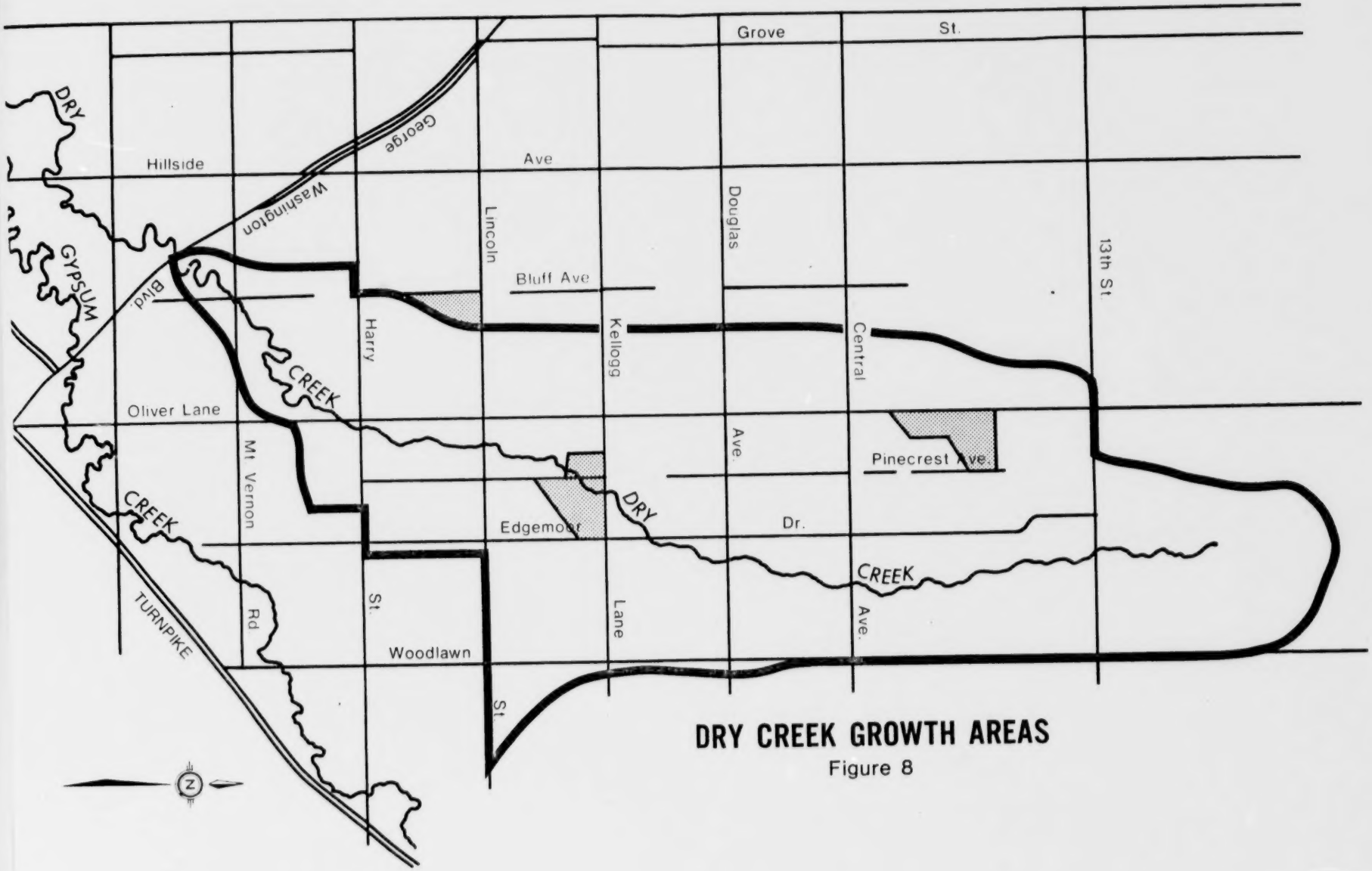
The Dry Creek Basin provides a wide diversity of employment opportunities. In 1973, approximately 4,482 job opportunities existed in the basin. This number is expected to increase to an estimated 4,963 by the year 2000 (Zonal Allocation-Land Use Plan 1977). Table II summarizes this information.

Parkland and Open Space

Open space opportunities within the Dry Creek Basin are provided in form of designated city parks and school playgrounds. Two parks and a golf course totaling 127.5 acres or 4 percent of the basin are maintained by the City of Wichita (Figure 9). The largest of these is L.W. Clapp Memorial Golf Course, a special use park. This area consists solely of an 18-hole golf course, situated on 90.7 acres. Edgemoor Park, a community park, is located on 25.5 acres and contains a recreation center, a lighted tennis court, ball diamond, a swimming pool, and children's play areas. Willow Park is located along the Dry Creek Drainage Way. This park encompasses 11.3 acres, is presently underdeveloped and

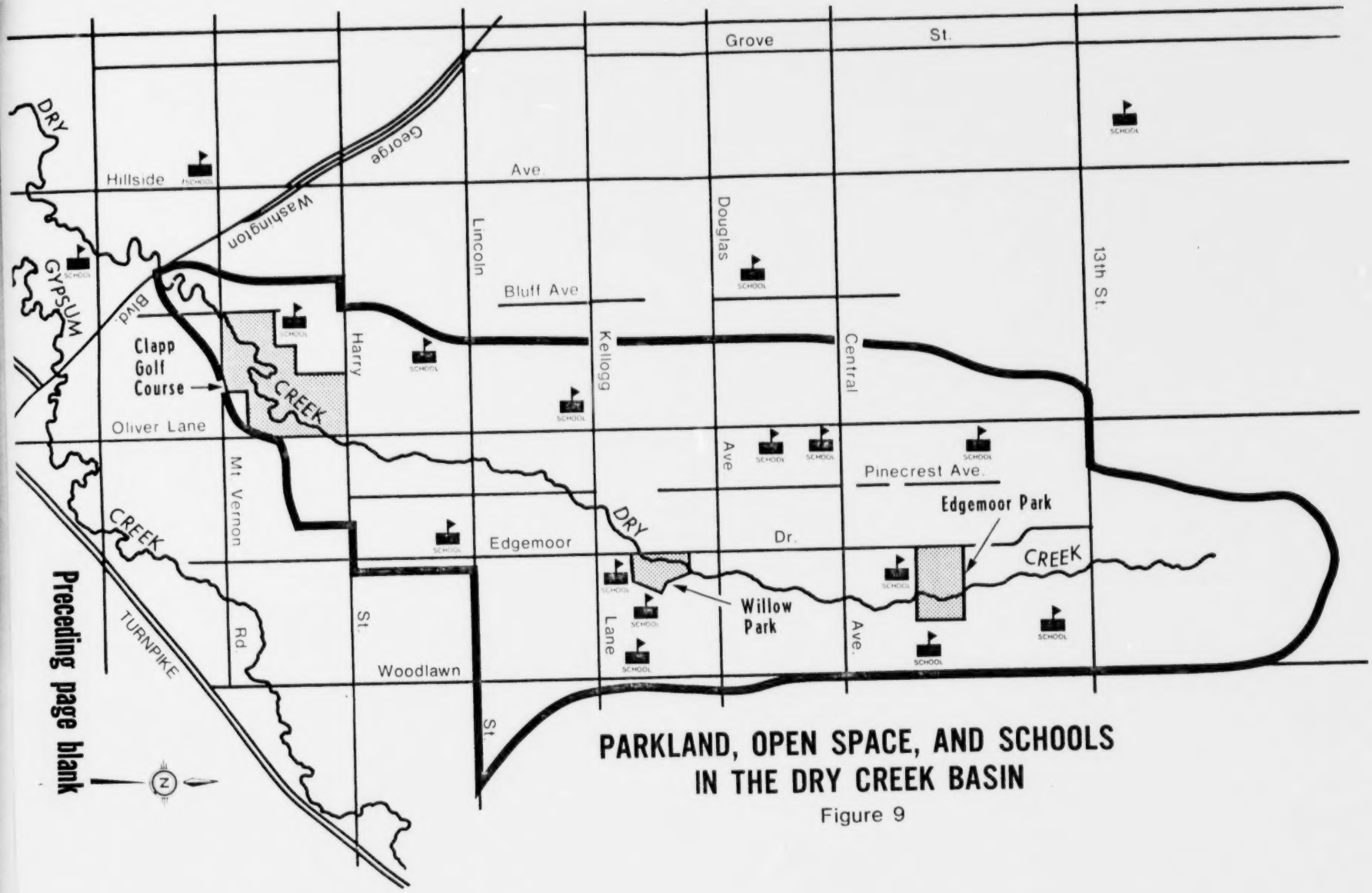
Table II: Employment Opportunities Within Dry Creek Basin

Employment Section	1976 Opportunities	2000 Opportunities	% Change
Retail	2040	2081	+ 2
Public or Semi-Public	1141	1406	+ 19
Service	750	925	+ 19
Industrial	281	281	0
Office	270	270	0



DRY CREEK GROWTH AREAS

Figure 8



PARKLAND, OPEN SPACE, AND SCHOOLS IN THE DRY CREEK BASIN

Figure 9

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serves primarily as a local green area.

City schools within the basin (Figure 9) also provide opportunities for recreation by local residents in the form of playground areas, and athletic fields.

Public Services

Both public and privately owned utilities are provided to basin residents. Public utilities include both potable water and wastewater services, both of which are provided by the City of Wichita. Gas and electricity are supplied by the Kansas Gas and Electric Company and telephone service is provided by the Southwestern Bell Telephone Company.

Fire and police protection are provided by the City of Wichita. Two of the city's 16 fire stations are located within or immediately adjacent to the Dry Creek Basin (Figure 10). Station Number 9, located at 4706 East Kellogg, has both pumping and aerial capabilities, as does Station Number 11, located at 1845 George Washington. Station Number 11 also serves as the rescue unit base station for Fire District 3.

Two hospitals, the U.S. Veterans Administration Hospital and St. Joseph's Hospital, are located either within or adjacent to the Dry Creek Basin (Figure 10).

Educational services are provided to the basin at both the primary and secondary levels. The locations of schools are shown in Figure 9. Religious services are provided by churches of many denominations. Locations of these churches are presented in Figure 10.

The Dry Creek Basin is provided with a surface transportation network in the form of expressways, arterial streets, collection streets, and public mass transit routes. The location of these transportation network facilities and mass transit routes are shown in Figure 11.

Cultural Resources

There are no known historic sites existing or proposed for listing in the Federal Register within the Dry Creek Basin (Kansas State

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Historic Preservation letter of March 10, 1978). However, a portion of the drainage basin, particularly the floodplain areas, offers a potential for archeological sites. These areas are located within a soil type, the Elandco silt loam, which apparently was favored by prehistoric residents.

Three archeological surveys have been conducted by the Office of the City Archeologist for this project. Surveys of January 4, 1978, and March 14, 1978, (Boydston 1978, A & B), were limited in scope to the route of the interceptor as originally proposed along Dry Creek and did not yield any archeological sites. A third survey was recently completed (Deel 1978) which included both a review of existing data to dtermine if an archeological site had been recorded from the Dry Creek Basin, and a pedestrian survey of undisturbed portion of Dry Creek. This survey and review did not result in identified sites. However, bone fragments of uncertain age and out of depositional context were noted between 9th Street and Murdock.

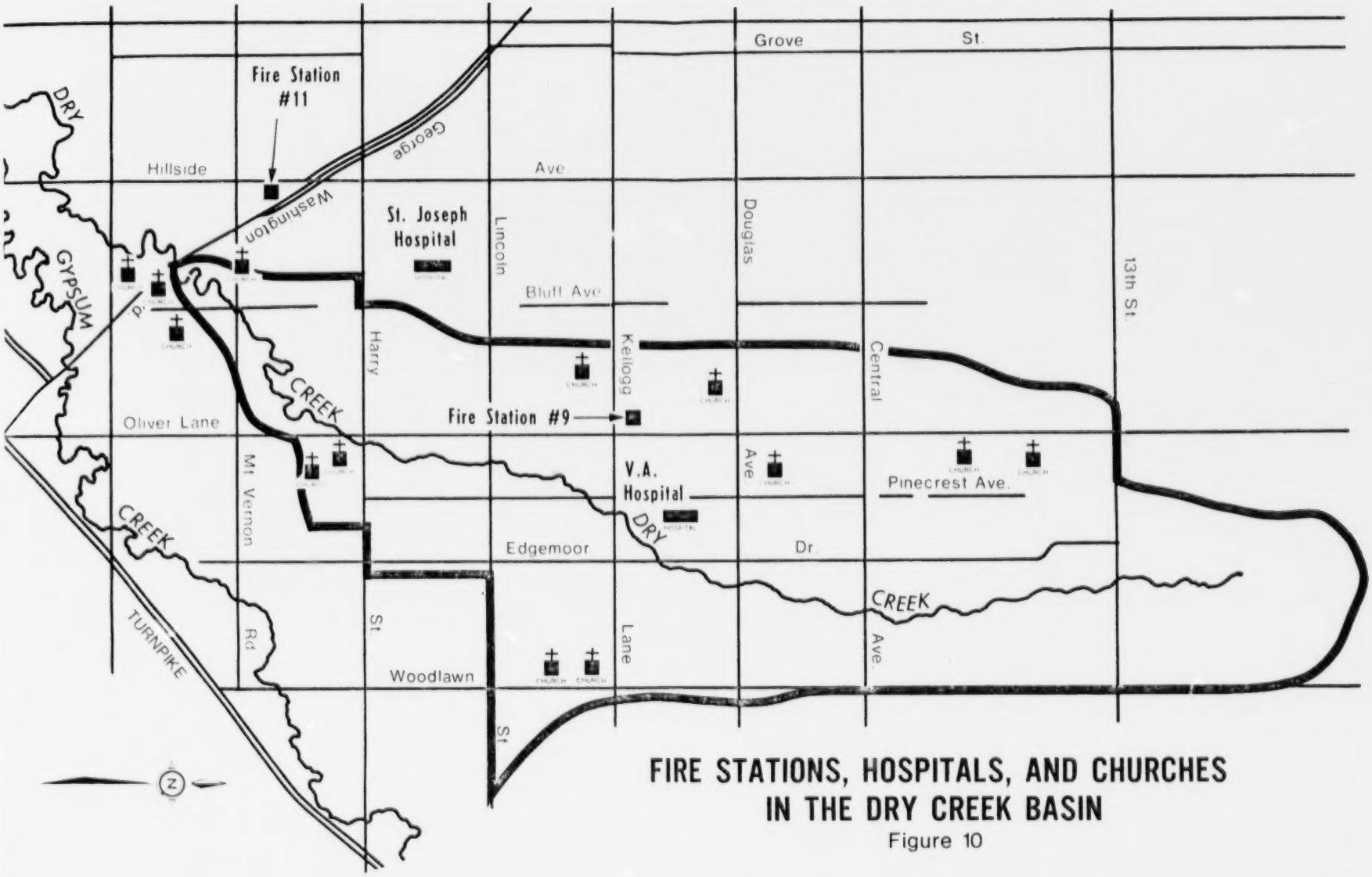
Noise

Information on noise levels within the Dry Creek Basin is extremely limited. Ambient noise levels for residents are somewhat dependent upon the distance the residences are located from arterial streets or commercial areas. Noise levels cited in the Negative Declaration for Federal Highway porjects along George Washington (1974), indicate ambient noise levels of from 59 to 69 dBA-L_{10} in residential areas immediately adjacent to this street and 67 to 73 dBA-L_{10} in light commercial areas.

An additional noise survey was conducted for this project by the Wichita-Sedgwick County Department of Community Health on September 22, 1978. The results of this investigation indicate that equivalent noise levels (dBA-Le_4) are similar to those along George Wasington. Noise survey location points and associated noise levels are presented in Figure 12.

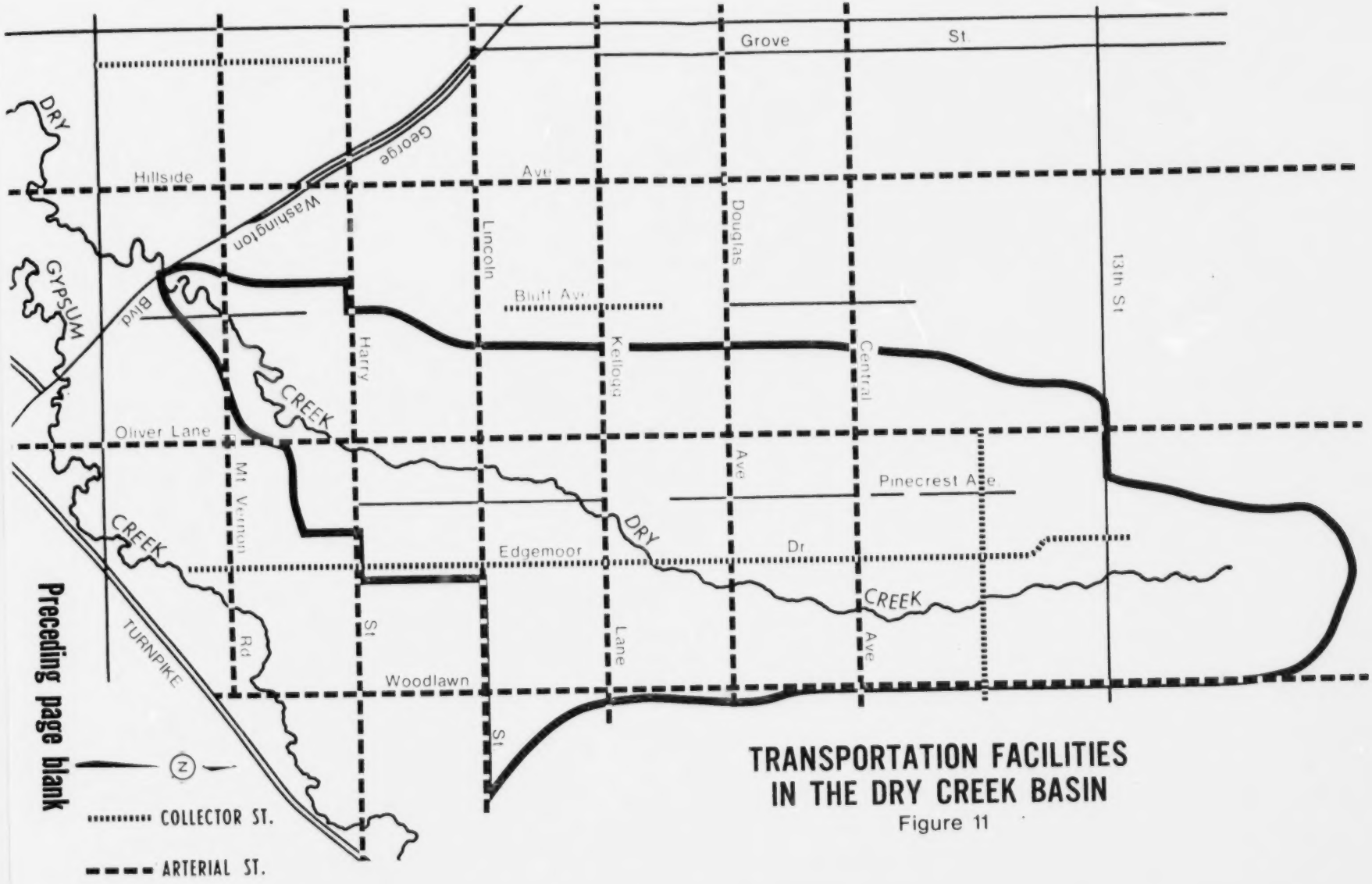
Biota: Dry Creek Basin

The history of urbanization within the Dry Creek Basin has had a marked effect on the biota of the basin. Generally, the native vegetation of the area was eliminated as development increased. A few scattered areas of vegetation, however, remain within the



FIRE STATIONS, HOSPITALS, AND CHURCHES IN THE DRY CREEK BASIN

Figure 10



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TRANSPORTATION FACILITIES IN THE DRY CREEK BASIN

Figure 11

NOISE SURVEY LOCATIONS

Figure 12

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basin. Generally, these areas are located adjacent to Dry Creek where topographic features have precluded development or where vegetation has been retained to provide shade and/or aesthetic value to the area.

Wildlife resources of the basin have generally responded to changes in basin vegetation. Within the highly developed portions of the basin, the fauna have generally been reduced to those species which easily coexist in urban areas. Typical species include such birds as; blue jays, starlings, robins, and house sparrows, and mammals such as rabbits, squirrels, and mice.

Biota: Dry Creek Channel Primary Issue Area

Flora

The principal area of remaining riparian habitat in the basin is an area along Dry Creek from the intersection of Mt. Vernon and Bluff to George Washington (Figure 13). Within the woodland, both species distribution and number of species are sporadic. This condition results from the actions of local landowners who have modified the woodland by converting riparian habitat to lawn or, in one case, have modified the habitat by realigning a section of the Dry Creek Channel. Table III presents information that indicates the degree of unevenness in the woodland.

Within the area delineated in Figure 13, a detailed inventory and analysis of the vegetation was conducted (Distler 1978). This area of riparian woodland consists of 9.0 to 10.0 acres (10.0 if background planting of exotic species which are contiguous with native vegetation is included). A total of 38 species of trees and shrubs have been identified from the riparian boundary (See Appendix I for species list). Of the 38 species encountered, four species: Elm, osage orange, cottonwood, and hackberry, constitute approximately 80 percent of the total number.

Fauna

Little detailed information is available on the fauna of the Dry Creek Channel area. Information appears to be limited to an inventory conducted in areas of potential primary impact and 23 years of bird observation by Mrs. John Wherry, a local resident and member of the Wichita Audubon Society.

WOODLAND HABITAT OF PRIMARY IMPACT AREA

Figure 13

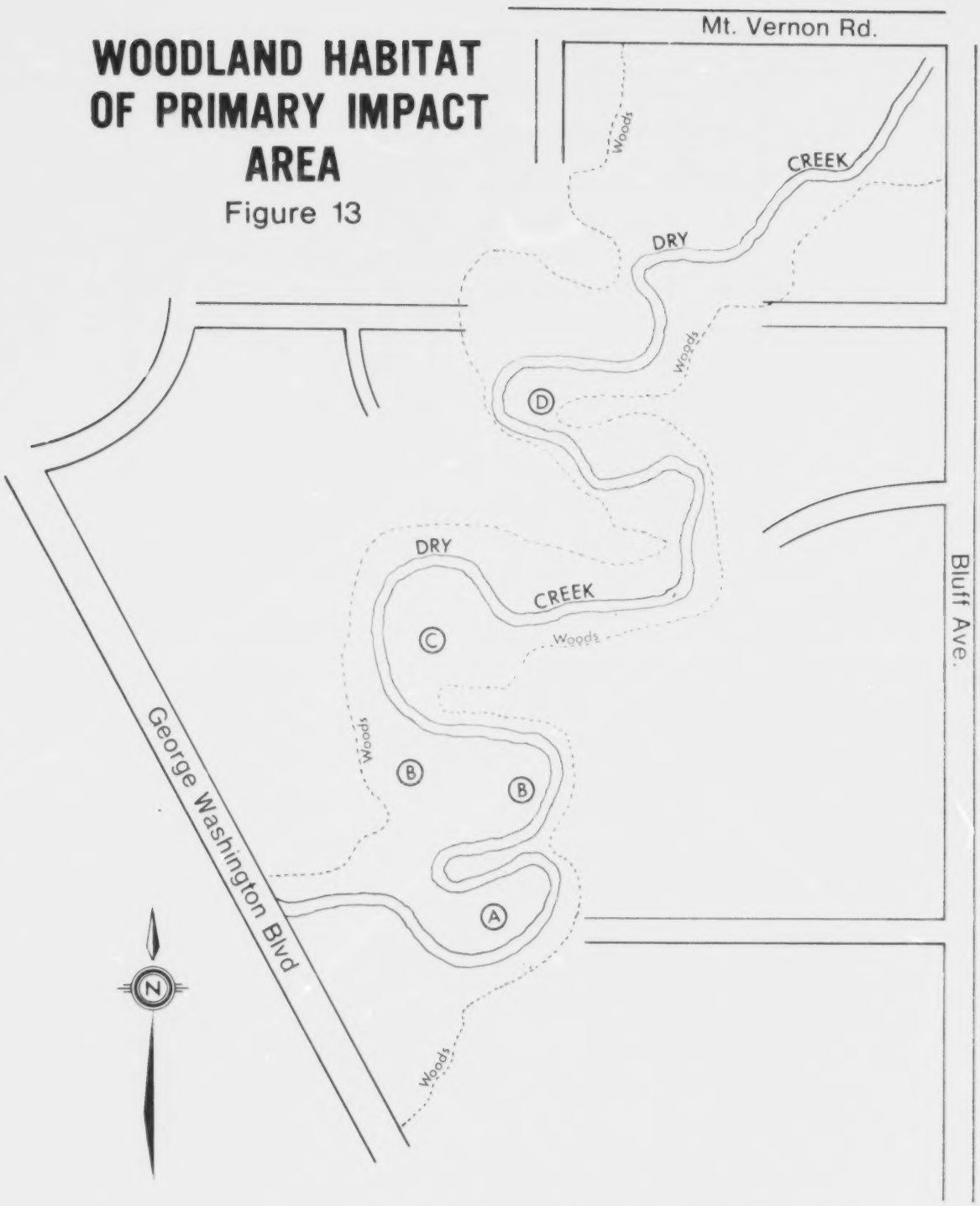

Table III: Woodland Densities Along Dry Creek Channel

Area	Dominant Trees	Density (Trees/Area)
A	Hackberry, Elm	277
B	Elm, Osage Orange	139
C	Cottonwood, Elm	228
D	Osage Orange, Elm	218
E	Elm, Osage Orange	158

The flow regime of Dry Creek, oscillating between periods of no-flow and flooding conditions and the small size of the stream are not conducive to the development of large or diverse fish fauna. Limited collections from the Dry Creek Channel in the potential impact area resulted in the confirmed presence of three species: Green sunfish, red shiner, and black bullhead. A fourth species, the fathead minnow, which commonly occurs in prairie streams which are subject to periodical drought conditions may also exist in the project area.

In regard to reptiles and amphibians, only three species of frogs were encountered during the 1978 inventory. The area, however, offers suitable habitat for a well-mixed community. Appendix I contains a list of known and expected reptiles and amphibian species for this area.

The mammalian fauna of Dry Creek are typical of what would be encountered in urban woodland areas of Kansas. Six species have been identified by sight or track: The eastern cottontail rabbit, the fox squirrel, the muskrat, the opossum, the raccoon, and the striped skunk. All of these species are typical of urban or urban-fringe areas. Additionally, the area contains suitable food resources, nesting areas, and escape cover for other migrant or transient species. Appendix I contains a list of known or expected species.

The area identified in Figure 13 supports what may be the most diverse bird fauna within the Metro-Wichita area. The blend of ecotypes i.e., open lawns, backyard plantings of exotic trees and shrubs, riparian woodland, and stream pools results in a wide range of ecological niches and is conducive to a diversity of fauna. A total of 102 species have been recorded in this area and suitable habitat exists for an additional 37 species. Although many of the 102 species have not been sighted in recent years, many exotic species or migratory transients have been recognized and the area does provide nesting requirements for approximately 57 species. As with other segments of the fauna, urban-fringe species are most commonly encountered. Appendix I contains a list of species known or expected to occur in the basin.

CHAPTER III: ALTERNATIVES

Introduction

When any project or improvement plan is under consideration, there are usually numerous alternatives which can be employed to achieve the desired goal. However, many of the possible alternatives are quickly proven unfeasible because of technical, environmental, or monetary restaints.

Dry Creek Interceptor Alternative

The Dry Creek gravity alternative would intercept wastewater flows from the existing Dry Creek sewer at the intersection of Mt. Vernon and Bluff and transport these flows via gravity along an alignment generally paralleling the existing 21-inch diameter Dry Creek sewer to George Washington. At George Washington the flow would be split: a portion continuing in the existing 21-inch sewer; and the majority being transported to the War Industry Sewer at Whitney Lane (Figure 14).

The estimated time required for construction, based on a construction rate of 30 feet per day, is 135 calendar days. The estimated total capital cost for this alternative is $786,237 and the estimated total present worth is $735,682. No increased operation and maintenance cost is associated with this alternative. Appendix II contains a cost breakdown for all alternatives considered in this study.

Mt. Vernon Gravity Interceptor Alternative

The Mt. Vernon gravity alternative would intercept flows from the existing Dry Creek sewer at the intersection of Mt. Vernon and Bluff and transport these flows via gravity in a 36-inch diameter sanitary sewer to an existing 42-inch sanitary sewer at Grove Avenue. This alternative requires limited but continued use of the existing Dry Creek sewer by converting its present 21-inch diameter to a 10-inch diameter. This constriction results from placing a 10-inch diameter plastic slipliner in the existing sewer and filling the space between the 10-inch and 21-inch pipe with a sandgrout mixture which prevents movement and provides structural integrity to the liner. The purpose of the liner is to provide sanitary sewer service

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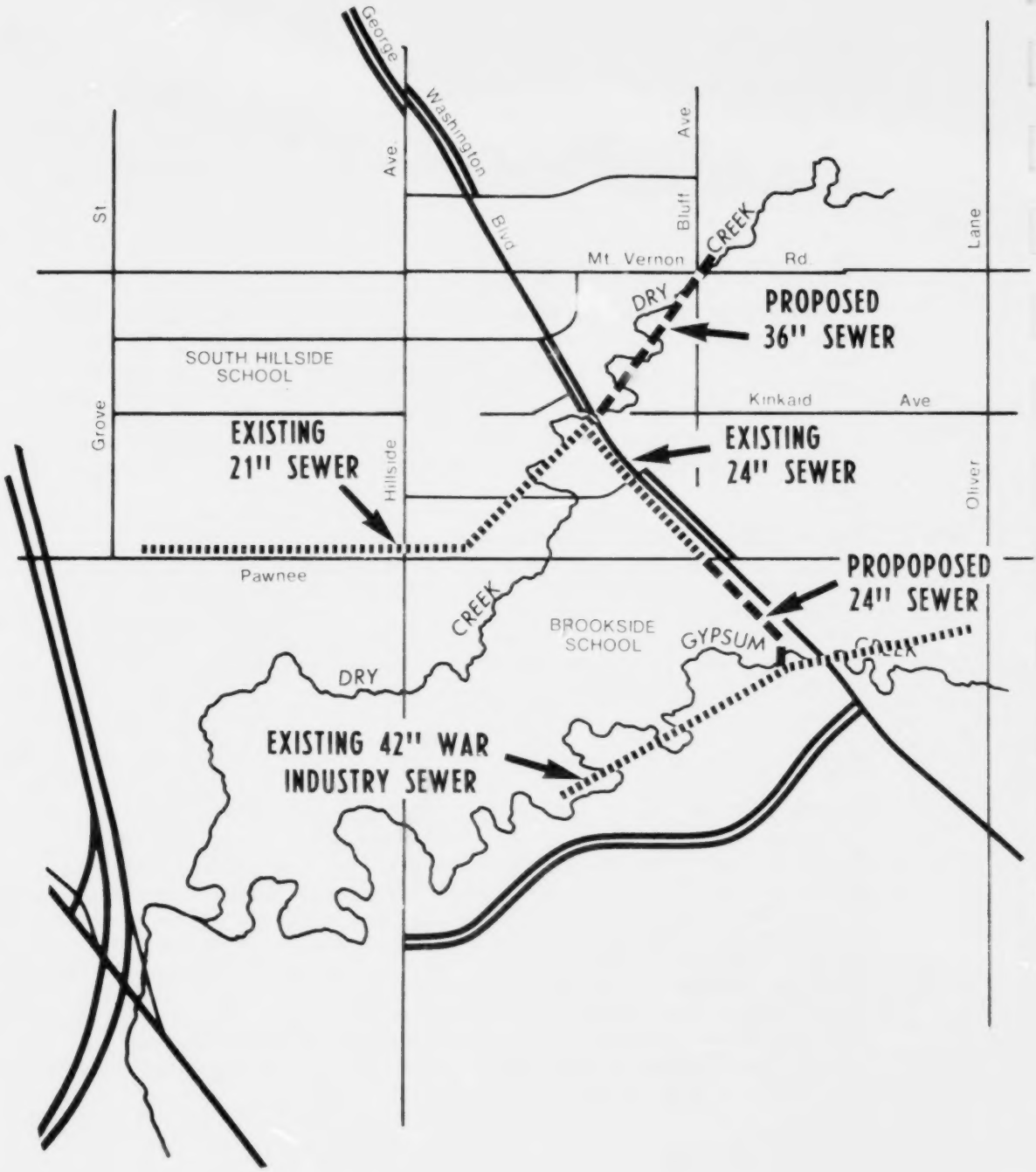
ROUTE OF DRY CREEK ALTERNATIVE

Figure 14



to areas served by lateral sewers and house connections which currently flow to the existing Dry Creek interceptor (Figure 15).

Based on an estimated construction rate of 30 feet per day, approximately 300 calendar days are required to complete this alternative. The estimated total capital cost of this alternative is $1,519,680 and the estimated total present worth is $1,398,723.

Mt. Vernon Force Main Interceptor Alternative

The Mt. Vernon force main alternative would provide a wastewater pumping station near the intersection of Mt. Vernon and Bluff and would pump the flows under pressure through a 20-inch pipe to an existing 42-inch sewer at Grove Avenue. As with the Mt. Vernon gravity alternative, sewer routing for this alternative would be entirely within the Mt. Vernon roadway (Figure 15). This alternative would require the placement of a 10-inch diameter slipliner in the existing 21-inch sewer for the same reasons presented in the Dry Creek alternative description. The estimated construction time for the Mt. Vernon alternative, based on a rate of 50 feet per day, is approximately 185 calendar days. (Shorter construction time is expected with a force main because it requires only a 5 to 10-foot deep trench.)

The total estimated capital cost for this alternative is $1,282,317. Additionally, this alternative will require an estimated $25,720 per year for operation and maintenance. The total estimated present worth of this alternative is $1,503,786.

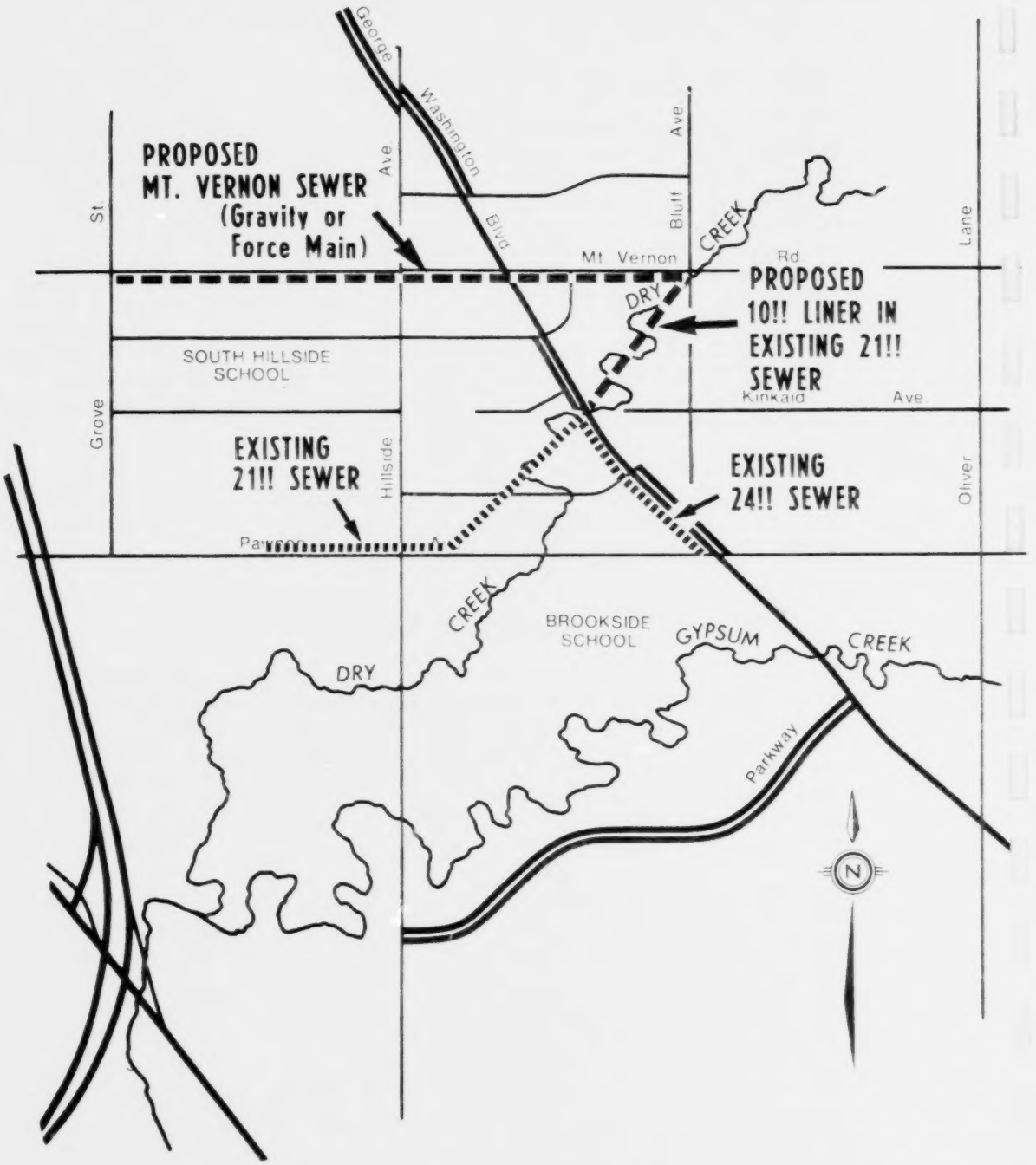
Bluff Gravity Interceptor Alternative

The Bluff gravity alternative would intercept wastewater flows at the intersection of Bluff and Mt. Vernon and transport these flows southerly via gravity along Bluff and then westerly along Kinkaid Street to George Washington. From George Washington, flow routing would be the same as for the Dry Creek alternative. The route for this alternative is shown in Figure 16. As with the Mt. Vernon alternatives, the Bluff alternative also requires a 10-inch diameter slipliner in the existing 21-inch Dry Creek sewer.

The estimated time required for construction, based on a construction rate of 30 feet per day, is 170 calendar days. The estimated total capital cost for this alternative is $945,491 and the estimated

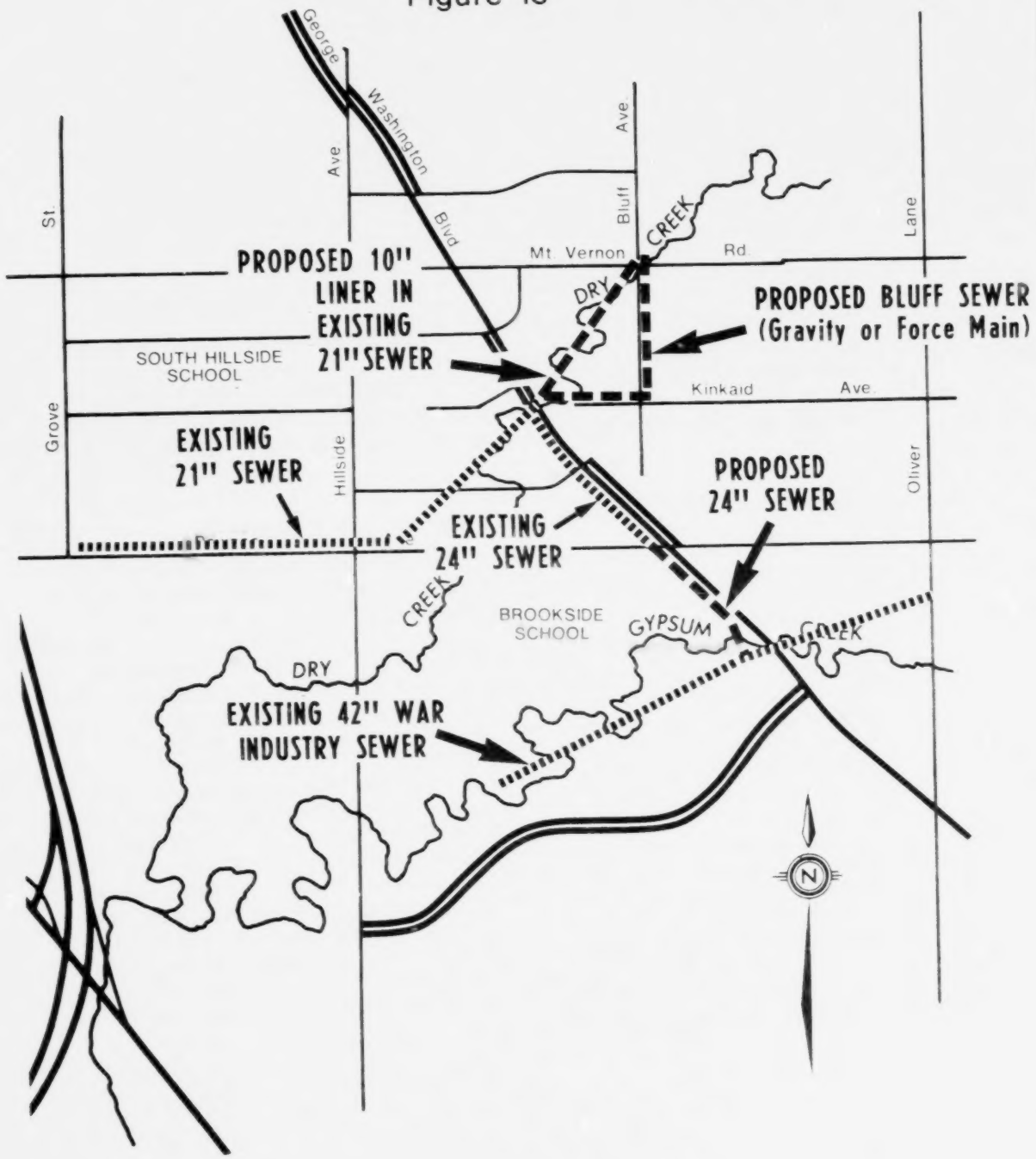
ROUTE OF MT. VERNON ALTERNATIVES

Figure 15



ROUTE OF BLUFF ALTERNATIVES

Figure 16



total present worth is $881,716. There are no additional operation and maintenance costs for this alternative.

Bluff Force Main Alternative

The Bluff force main alternative would provide a wastewater pumping station near the intersection of Mt. Vernon and Bluff and pump flows under pressure through a 20-inch diameter pipe along a route identical to the Bluff gravity route. At George Washington, the wastewater would flow via gravity along the same route described for the Dry Creek and Bluff gravity alternative. Routing for the Bluff force main alternative is shown in Figure 16. As with the Mt. Vernon alternative and the Bluff gravity alternatives, the Bluff force main alternative would require the placement of a 10-inch diameter slipliner in the existing 21-inch diameter Dry Creek sewer.

The estimated construction time for this alternative, based on a construction rate of 30 feet per day, is 120 calendar days. The estimated total capital cost is $1,096,600 and the total present worth is $1,160,085. This alternative would require an estimated $9,550 per year for operation and maintenance of the pumping station.

No Action Alternative

Consideration was given to the no-action alternative. This alternative means that a grant for corrective action would not be made by EPA to assist the City of Wichita in alleviating the current interceptor problem in the Dry Creek area between Mt. Vernon, Bluff, and George Washington. An analysis of the no-action alternative indicates that it is unfeasible primarily because the existing flow capacity of the Dry Creek sewer is insufficient to transport all wet weather flows. During wet weather periods, flow in the Dry Creek sewer system increases dramatically. This increase is due primarily to rainwater which enters the sewer through cracks and holes which result from the age and deteriorated condition of the present sewer. As a result, sewage backs up in the collection system above Mt. Vernon and Bluff, which causes sewage to enter homes in the vicinity of Bleckley and Harry Streets. During these periods of excessive flow, the sewage which is diverted into the adjoining sewer basin also causes the 24-inch sewer to exceed its capacity and causes sewage to overflow into basements along Mt. Vernon west of Bluff. Without increasing the capacity of the Dry Creek sewer and elimination of the inter-basin diversion, these overflows into homes will continue.

A second consideration in rejecting the no-action alternative is the structural condition of the existing Dry Creek interceptor. Video tapes of the sewer, made in 1974 by the City of Wichita, were reviewed by EPA regional personnel. This review indicated that the existing Dry Creek interceptor contains cracks along approximately 33 percent of its length, has several pipe joints which are out of alignment, and has sagged or settled below its original position in several locations. While none of the structural deficiencies indicate imminent failure of the line, a period of prolonged wet weather sufficient to raise the water table above the sewer could change the supportive properties of the soil and cause line failure (Walker 1978).

CHAPTER IV: ENVIRONMENTAL IMPACTS OF ALTERNATIVES

Several impacts which have been identified apply equally to all alternatives under consideration.

Increased Noise Levels

Local noise levels for all alternatives will temporarily increase due to construction. The present noise levels within the potential impact areas are from 58 to 74 decibels. Noise resulting from construction equipment is estimated to be approximately 88 decibels (Center 1977). This level would result in a cumulative noise level of approximately 89 decibels at a distance of 50 feet from the site or 83 decibels at 100 feet. The latter level is approximately equal to the noise level of a typical city bus measured at 50 feet.

Few direct mitigative measures can be employed to reduce noise impacts. The impact of noise on the local population can be decreased by limiting construction activity to the daytime hours and requiring that equipment is maintained in a working condition that will not result in operational noise levels that exceed the Public Building Service Specifications of 1973.

Decreased Property Values

An evaluation of the impacts of the feasible alternatives on residential property values within the Dry Creek study area by the Department of Housing and Urban Development (HUD) indicates that these alternatives will cause no measurable damage to property owners (Anderson 1978). A survey of the market values of over 200 home sales within the basin area indicated that homes with wooded areas at the rear of the property sold at a comparable price to sales of homes without this rustic atmosphere. Additionally, the corridor effect would not be visible to home owners whose field of view is perpendicular to the corridor because of screening by the remaining trees.

Increased Urban Development

Increased urban development has often been associated with the

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construction of sanitary sewers. One consequence of development is an increase in storm water runoff resulting from an increase in the amount of impervious area.

None of the alternatives being considered for funding by EPA are considered to be a potential direct or indirect cause for increasing storm water runoff. While all alternatives require increased interceptor capacity, the exclusive purpose of this increase is to transport basin flows resulting from excessive infiltration and inflow. The present interceptor capacity is sufficient to transport dry weather flows of the ultimate basin population.

Dry Creek Alternative

Decreased Aesthetic Value

This alternative would have the greatest impact on the aesthetic value of the Dry Creek area because it requires the construction of approximately 1700 feet of pipe through the Dry Creek area. Necessary site clearing, excavation, and related construction activities would result in a corridor through an area of aesthetic value to some residents. The required corridor would encompass approximately 1.92 acres of which 1.35 acres consist of an aesthetically pleasing wooded area (Figure 17). The aesthetic impacts of this alternative can be somewhat mitigated by revegetation of the corridor. However, unless replanting provides trees of equal maturity of the contiguous woods, the impact will not be completely mitigated. A revegetation scheme which creates a visual barrier of mature trees at the ends of the corridor coupled with plantings of smaller trees at other locations would be effective and feasible.

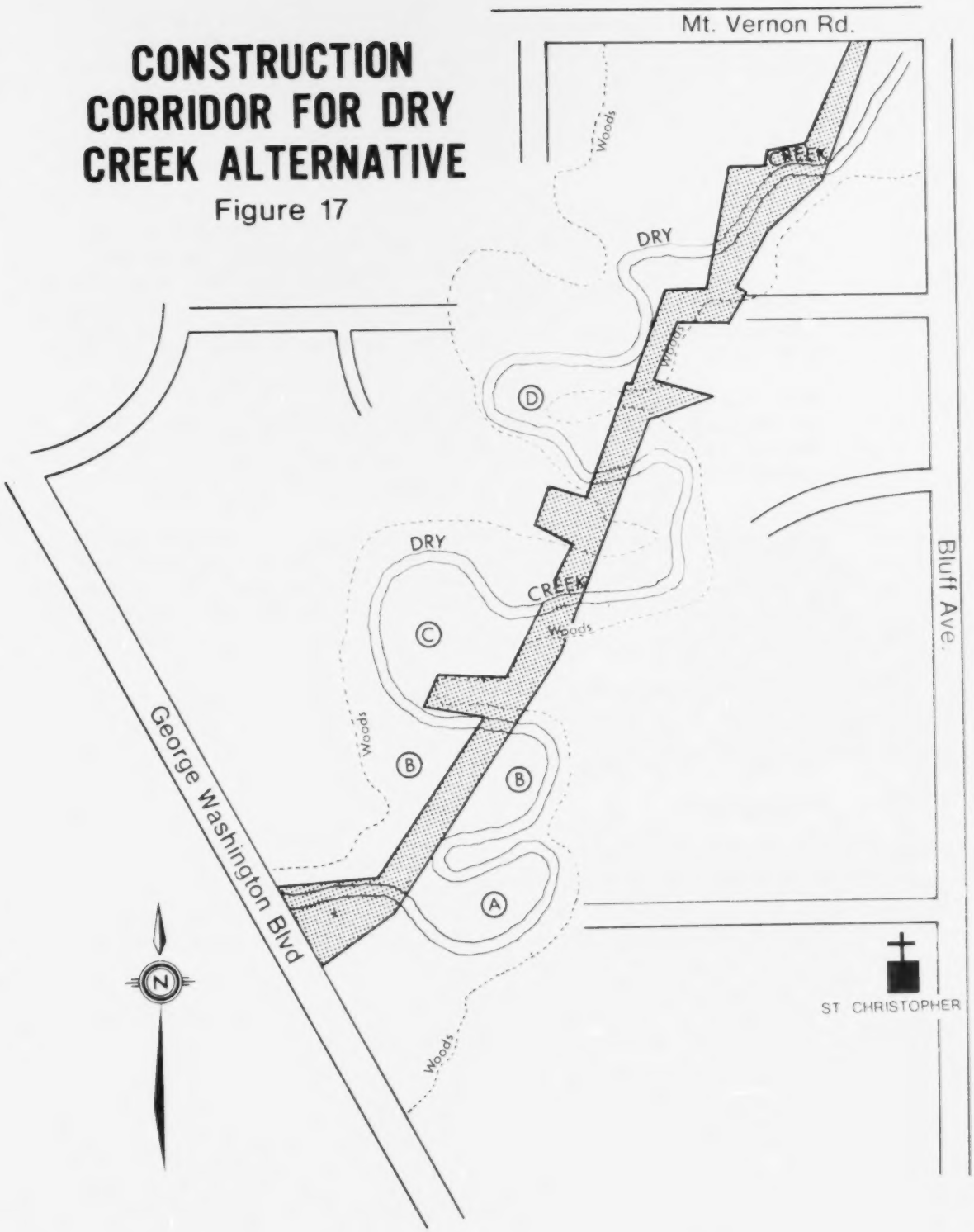
Disruption of a Natural Area and Its Associated Wildlife

The Dry Creek alternative would result in the most serious impact on the natural environment of the Dry Creek area. Sewer easements, both permanent and temporary, encompass an area of 1.35 acres of riparian woodland or about 13.5 percent of the total riparian acreage.

A total of 133 trees greater than 4.5 inches in diameter or approximately 6 percent of the total woodland trees are located within these easements. Elms dominate both in number (50) and percent (38) followed by osage orange with 39 trees and 29 percent of the total, and hackberry with 13 trees and 10 percent of the total trees within the easement. The remaining 22 percent of the trees

CONSTRUCTION CORRIDOR FOR DRY CREEK ALTERNATIVE

Figure 17



are mulberry, black walnut, boxelder, willow and red cedar.

Several impacts of tree removal on wildlife can be expected. Approximately 57 of the trees (43 percent) marked for removal are considered food or "mast" trees. Of these, 33 are osage orange, a tree of marginal value as wildlife food, but the remaining 24 are of substantial food value. Since there is an even dispersion of food source trees throughout the woodland, any areal reduction from construction activities represents a concurrent loss of wildlife food sources.

In addition to removing a portion of the wildlife food source, removal of trees will impact area wildlife by removing potential nest and cover areas. The extent which nest and cover area modifications will impact the area is not totally known. One such impact could be a slight decrease in the number of typical local woodland species with corresponding increase in open area or edge species of wildlife.

Tree and undergrowth removal may also result in increased competition between species for nesting sites. If sufficient suitable nesting sites are not available in the undisturbed areas, some species may be forced to seek nesting sites in other areas.

The impact of this alternative on the natural environment can be greatly mitigated by vigorous site restoration work and construction timing. Development and approval of a revegetation strategy by a wildlife biologist to incorporate increased food availability, escape cover, and adequate nesting sites would greatly reduce the impacts of this alternative on the natural environment.

Timing of construction activities would also help mitigate the impacts of this alternative. Limiting construction activity and intrusion to nonbreeding periods (winter months) would minimize the impact on resident wildlife.

Stream Erosion

The Dry Creek alternative offers the potential for the greatest increase in stream bank and bed erosion during construction because this alternative requires five creek crossings. Each of these crossings may result in serious erosion as a result of bank modification and tree removal.

The impact of creek crossings and bank erosion can be mitigated

in several ways. Erosion resulting from construction can be controlled by the development of a site-specific erosion and sediment pollution control plan as required by EPA requirements (Program Requirement memorandum 78-1), and by scheduling construction activities for the low rainfall months of November through March. Post-construction erosion can be mitigated by requiring that erosion protection and bank stabilization devices such as gabions and rock riprap be installed at each creek crossing.

Public Safety

This alternative would have relatively minor impact on public safety. In the area between the intersection of Bluff and Mt. Vernon, and George Washington, construction activities would be in an area remote to normal pedestrian or vehicular traffic. As such, public safety impacts on both pedestrian and vehicular traffic are minor. Within the construction area along George Washington sufficient off-road right-of-way exists to minimize traffic disruption.

Several mitigative measures can be employed to reduce impacts on public safety. Pedestrian safety can be protected during working hours by on-site control. During non-construction hours, required backfilling of trenches or covering trenches with nontamperable material, such as steel plates, would eliminate this hazard to public safety.

The impact on vehicular traffic safety can be greatly mitigated by maintaining as nearly normal a traffic flow as possible. Where this is not possible, traffic warning signs and public announcements, via the media, of the danger and alternative routes can be employed.

Public Inconvenience

Inconvenience to area residents resulting from implementation of the Dry Creek alternative would be limited to the portion of the route along George Washington. Approximately seven private accesses would be affected, in addition to the intersection of George Washington and Pawnee. Mitigative measures which can be employed to minimize these impacts include providing temporary street access and scheduling of construction activities during nonrush hours.

Mt. Vernon Road Gravity and Force Main Alternative

These alternatives are being considered together because they have nearly identical impacts on the environment, the only difference being that the Mt. Vernon force main alternative would require increased energy use to transport the wastewaters.

Energy Use

The Mt. Vernon force main requires the use of pumps to transport wastewater flows and, as such, would impact the environment by requiring increased energy use to operate the pumps. This alternative requires a series of pumps which produce a total of 350 horsepower. Operation of these pumps will require approximately 514,400 kilowatt hours of electricity per year or the amount of electricity consumed by 57 typical homes in Wichita. There is no method available to mitigate this impact.

Decreased Aesthetic Value

Minor impacts on the aesthetic environment may result from placement of the required 10-inch liner, reconnection of service liner, and manhole modification. Placement of the liner will require excavation of the existing sewer at two or three locations. Each of these excavations (0.023 acres each) and access for service reconnection and manhole modification (Figure 18) could result in temporary decreased aesthetic quality.

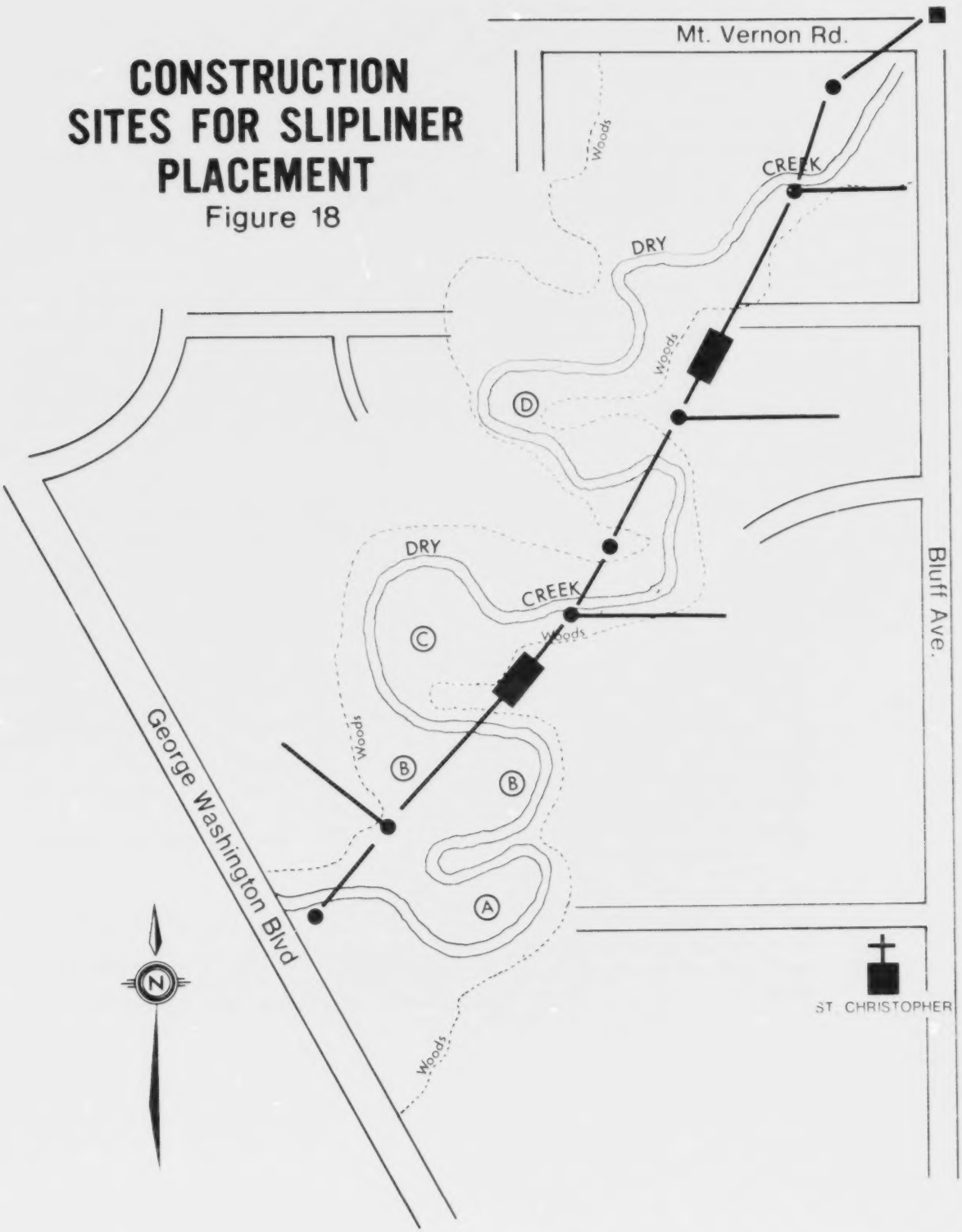
Mitigation for impacts of these alternatives on aesthetic values can be accomplished by two methods. The first method requires careful planning. The location of the excavations required to insert the liner can be arranged, within acceptable technical limitation, to avoid areas of exceptional aesthetic value. As with planning for liner pull sites, careful planning of access to sites necessary for lateral connections and manhole modifications can be used as mitigation where possible. Additional mitigation can be accomplished by limiting the access to the shortest and narrowest dimensions and by revegetation to a nearly original condition.

Disruption of a Semi-Natural Area and Its Associated Wildlife

The impacts on the semi-natural Dry Creek and its wildlife from these alternatives would result specifically from the installation of the plastic liner, service and lateral line reconnection and manhole modification. At these locations, the possibility exists that construction and access could result in the removal

CONSTRUCTION SITES FOR SLIPLINER PLACEMENT

Figure 18



of some vegetation which is used as food source, nesting sites, or escape covers for wildlife in the area. The relatively small area disturbed and short duration of intrusion reduces the severity of this impact.

Impact mitigation can be accomplished by planning access points and construction time to have the least deleterious effect on the area. In areas where vegetation must be removed, replanting to provide maximum wildlife benefits can be required.

Stream Erosion

Both Mt. Vernon alternatives would have little impact on construction induced stream bed and bank erosion since they do not require sewer construction and excavation at creek crossings. These alternatives however, present a potential impact where passage of equipment across the creek channel may be required to insert the 10-inch sewer liner, modify manholes, or make lateral and house connections.

Public Safety

The principal impact on public safety, both pedestrian and vehicular, is due to trenching operations. With regard to pedestrian traffic, the major concern is the danger of unauthorized persons entering the trench either by accident or on purpose. The greatest period of danger is during non-construction hours when on-site supervision is lacking. Safety impacts to vehicular traffic are also the result of trenching operations. Mt. Vernon, along the route of these alternatives, overlays several sanitary and storm sewers. The position of these sewers makes it difficult to confine trenching operations to the edge of the street or right-of-way. This may necessitate closing one or more traffic lanes. Because Mt. Vernon is a major arterial street which carries an estimated 10,000 to 12,000 vehicles per day (Traffic Engineering Department), and intersects additional arterial streets, a reduction in traffic capacity could greatly increase the potential for traffic mishaps.

Several mitigative measures can be employed to reduce impacts on public safety. Pedestrian safety can be protected during working hours by on-site control. During non-construction hours a requirement that trenches be backfilled or covered by nontamperable material, such as steel plates, would eliminate this hazard to the public safety.

The impact on vehicular traffic safety can be greatly mitigated by maintaining as nearly normal a traffic flow as possible. Where this is not possible, traffic warning signs and public announcements, via the media, of the danger and of alternate routes can be employed.

Public Inconvenience

Construction along Mt. Vernon has the potential for inconveniencing approximately 60 residences with driveways which enter directly off Mt. Vernon, 33 residences on Lorraine, a deadend street with access off Mt. Vernon, three churches, various access points, and a shopping center (Figure 19). Additionally, eight streets must be completely or partially crossed. Each of these crossings would cause inconvenience due to reduced traffic speeds.

Mitigation by providing temporary access, either by backfilling excavation to grade or by providing steel plate bridging, would greatly reduce the inconvenience of those who require access to Mt. Vernon. Additionally, timing work activities to avoid, if possible, periods of peak traffic through intersections and in and out of driveways would also mitigate this impact.

Bluff Street Gravity and Force Main Alternative

These alternatives are being considered together because they have nearly identical impacts on the environment. The Bluff force main alternative differs because it requires pumping the wastewater and hence an increase in energy consumption.

Energy Use

The Bluff force main alternative would require a series of pumps capable of supplying 130 horsepower. The annual energy consumption of these pumps would be 191,000 kilowatt hours of electricity or the amount consumed by 21 typical Wichita single-family homes. There is no method available to mitigate this impact.

Decreased Aesthetic Value

As previously outlined, these alternatives require construction of the transport pipe and lining to the existing 21-inch sewer to carry flows from laterals and house connections. Aesthetic impacts and mitigative measures associated with lining the existing

sewer are similar for both Mt. Vernon alternatives.

In addition to aesthetic impacts from placement of the sewer liner, the Bluff alternatives also impact upon an additional aesthetically pleasing wooded area of approximately 0.38 acres required for a construction corridor (Figure 20). As is true of the Dry Creek aesthetic impact, this alternative would impact most seriously on residents with a field of view parallel to the corridor.

Mitigative actions which could be incorporated with these alternatives include route planning to minimize aesthetic degradation, revegetation and planting to create visual barriers, and limiting corridor width to the minimum required for construction.

Disruption of a Semi-Natural Area and Its Associated Wildlife

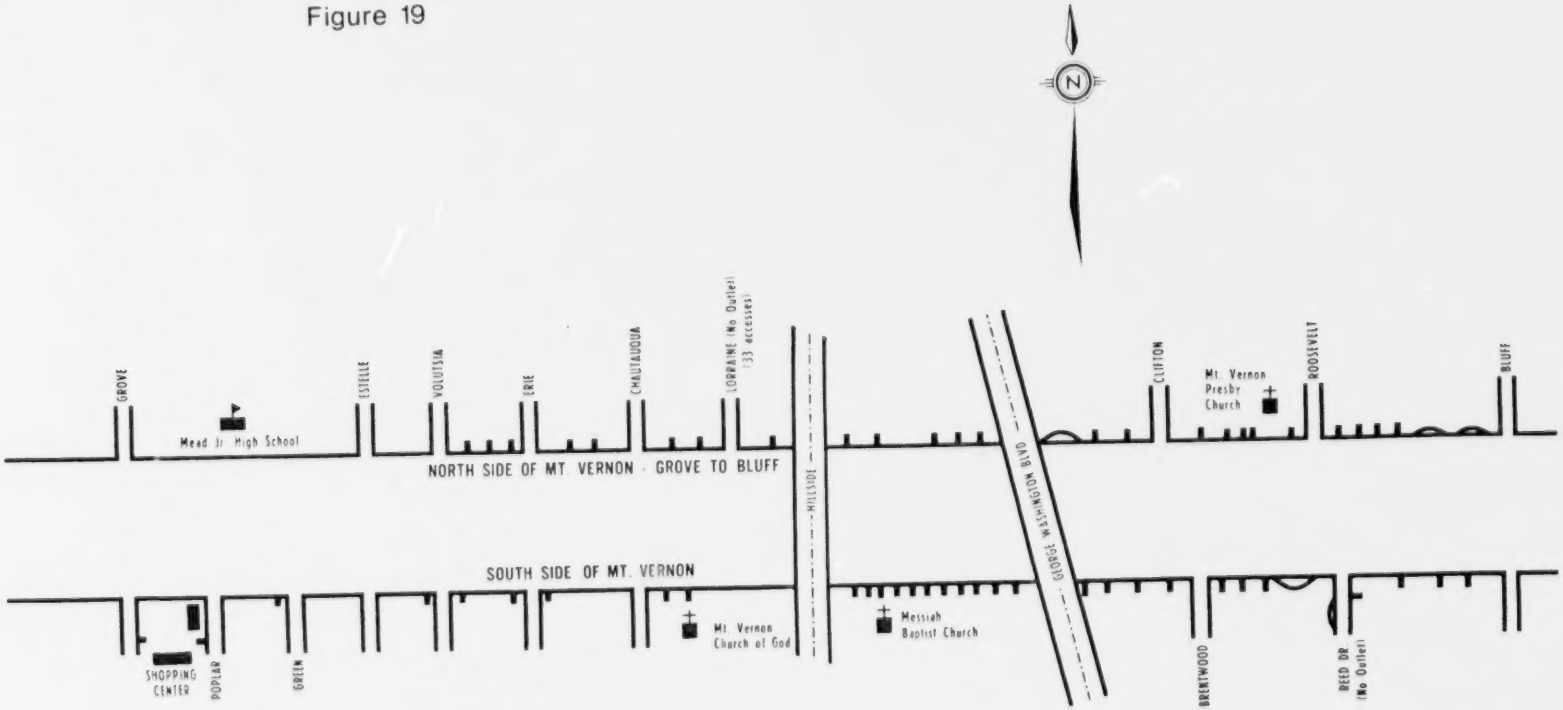
These alternatives impact on the natural environment in two ways: placement of the liner; and construction of new sewers. Both require intrusion into the wooded Dry Creek corridor to place a liner in the existing sewer. The impacts associated with liner placement are the same as those presented for the Mt. Vernon alternative. In addition to this disturbance, an additional 0.38 acres of riparian woodland (3.8 percent of the total) would be impacted for the placement of the new sewer (Figure 20). The corridor required for these alternatives would pass through one of the most densely wooded portions of the Dry Creek area. Approximately 118 trees (5.5 percent of the total trees in the woodland) would be removed, 88 percent of which are food or "mast" trees. As with the Dry Creek alternative, the removal of trees will result in the loss of wildlife food source, nesting, and escape cover. Mitigative measures for these alternatives are similar to those present for the Mt. Vernon alternative (liner placement) and the Dry Creek alternative.

Stream Erosion

These alternatives could increase stream bank and bed erosion as a result of construction activities required for insertion of the 10-inch diameter plastic sewer liner and because these alternatives require two creek crossings. The impacts associated with liner placement are the same as those presented for the Mt. Vernon alternatives. The impacts associated with the required creek crossings are the same as those presented for the Dry Creek alternative. All mitigative measures which can be applied to the Mt. Vernon alternatives and the Dry Creek alternative are appropriate to the Bluff alternative.

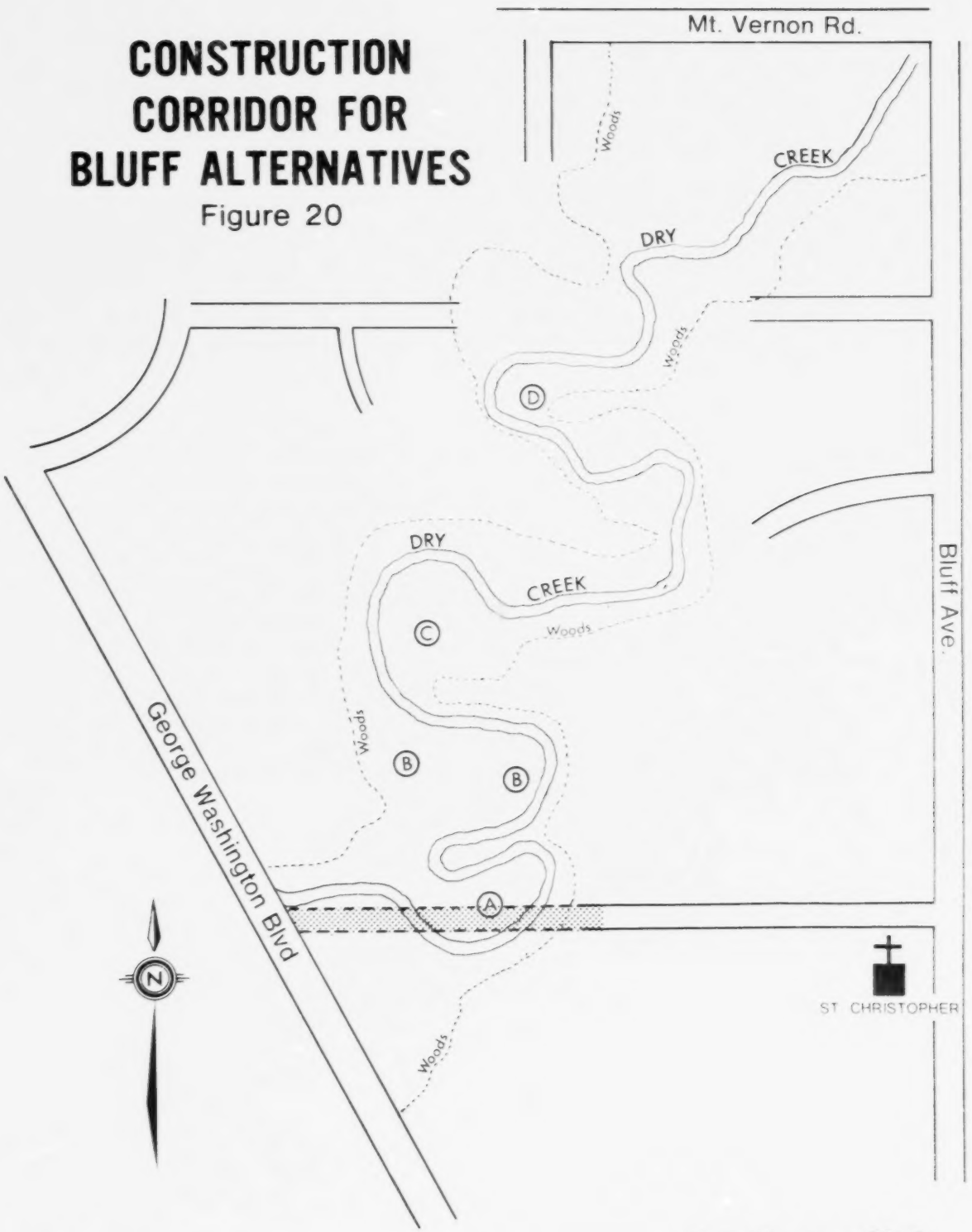
POTENTIAL ACCESS DISRUPTION FOR MT. VERNON ALTERNATIVES

Figure 19



CONSTRUCTION CORRIDOR FOR BLUFF ALTERNATIVES

Figure 20



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Public Safety

The Bluff alternatives present a special impact on public safety in regard to the section of routing along Bluff and Kinkaid. This portion parallels a route taken by area school children who attend Griffith Elementary School. The natural curiosity of young children makes them particularly susceptible to the dangers associated with trenching operations.

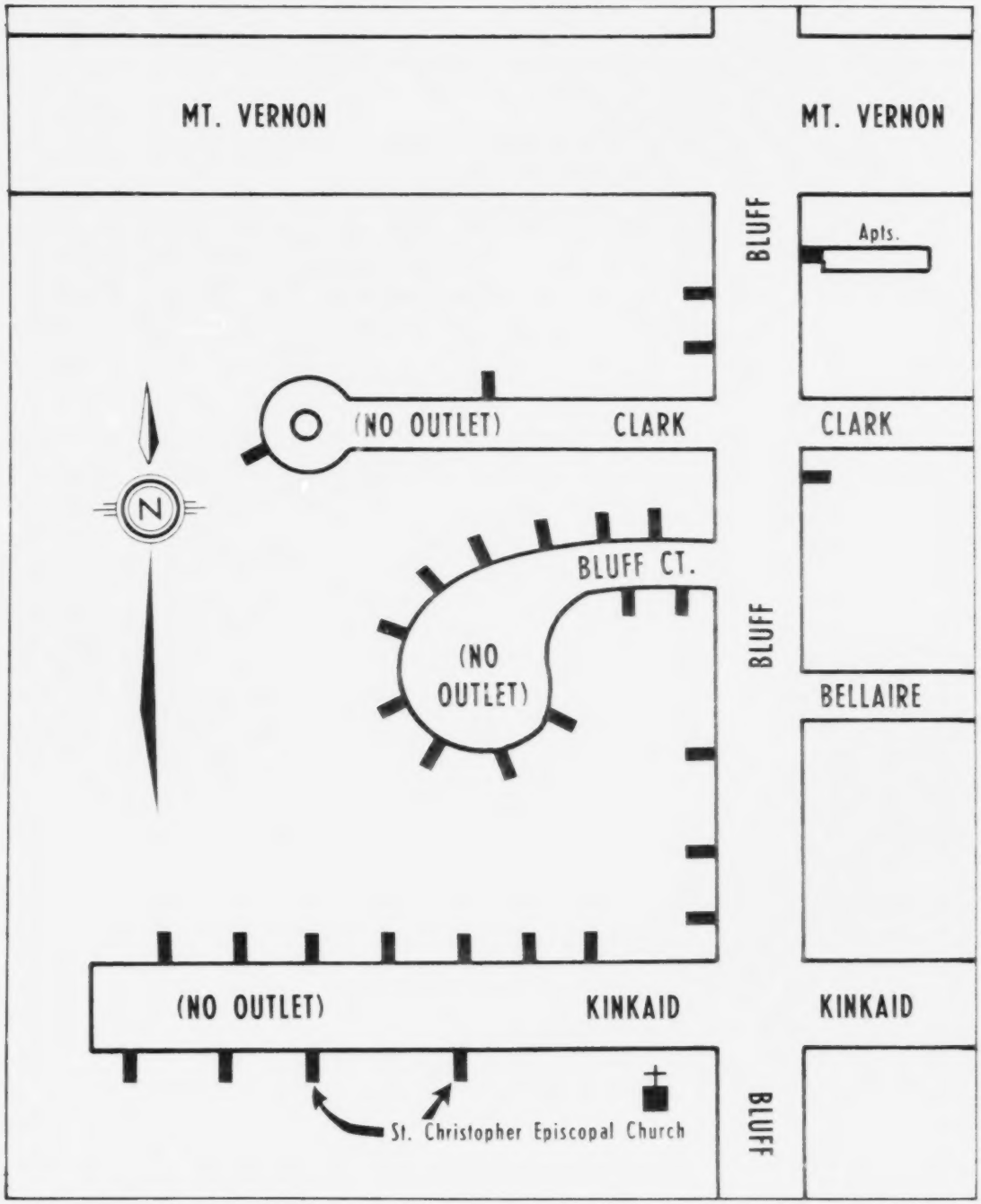
The impact on traffic safety is not severe because both Bluff and Kinkaid are residential streets and construction between Pawnee and Whitney Lane can be accomplished in off-road right-of-ways. Mitigative strategies presented for the Mt. Vernon alternatives apply to these alternatives. Additionally, an educational program by parents and school officials on the potential hazards of this construction could be implemented to reduce the potential for injury.

Public Inconvenience

The Bluff alternatives, by virtue of their identical routing, will result in similar temporary inconveniences to residents. These routes have the potential to impact either seven residences and one church, or 26 residences in the areas along Bluff and Kinkaid (Figure 21). The difference in numbers of residents is dependent upon which side of the street excavation takes place. Utilization of the east side of Bluff and the south side of Kinkaid would affect the least number of residences in this area. These portions of the interceptor route would also reduce traffic flow along its entire route and result in crossing three intersections. Routing the interceptor southeast of Pawnee along George Washington would impact on seven private accesses and the intersection of Pawnee and George Washington. The impacts of these alternatives can be mitigated by method described for the Mt. Vernon alternatives.

POTENTIAL ACCESS DISRUPTION FOR BLUFF ALTERNATIVES

Figure 21



CHAPTER V: UNAVOIDABLE IMPACTS OF ALTERNATIVES

Introduction

Although mitigative strategies can often be employed to eliminate impacts, certain impacts are unavoidable and incapable of being completely mitigated. This section presents a summary of unavoidable impacts for each alternative. Increased ambient noise levels are an unavoidable impact of all alternatives.

Dry Creek Alternative

Aesthetic Values

Incorporation of revegetative strategies which create a visual barrier to the construction corridor would reduce this impact. Also, additional plantings within the corridor would help mitigate this impact. This alternative, however, will have some unavoidable impacts on the aesthetic value of the Dry Creek area as a result of tree removal.

Disruption of the Semi-Natural Area and Its Associated Wildlife

The revegetation of disturbed areas with plants valued as wildlife food sources and cover will reduce or eliminate most of the unavoidable impacts associated with construction activities. The decrease in tree density and loss of mature trees as a result of construction, however, is an unavoidable short-term impact.

Increased Stream Erosion

With the development and implementation of a site-specific erosion and sediment pollution control plan, erosion during construction will be greatly reduced. Construction activities will cause some unavoidable increase in erosion, but gabions and riprap at channel crossings will greatly mitigate long-term erosion potential.

Public Inconvenience

Mitigation in the form of temporary access will eliminate this impact. An unavoidable impact will exist during periods of time when trenching operations are directly in line with access points.

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Public Safety

While mitigation measures such as prohibition of open excavations during non-working hours and provisions of traffic warning signs and controls mitigate public dangers, there are always some unavoidable hazards associated with construction.

Mt. Vernon Alternatives

Aesthetic Values

If the mitigation measures previously described are followed, these alternatives will have essentially no impact on aesthetic values.

Disruption of the Semi-Natural Area and Its Associated Wildlife

These alternatives have essentially no impact if the previously described (Chapter IV) mitigative measures are incorporated.

Increased Stream Erosion

With the incorporation of mitigative strategies there are essentially no unavoidable impacts associated with these alternatives.

Public Inconvenience

An unavoidable impact of vehicular inaccessibility will exist with these alternatives during times when construction activities are in line with access points. During other periods mitigative measures will essentially eliminate this impact.

Public Safety

Although mitigative measures can be employed to reduce the impact of construction on public safety, this impact cannot be completely mitigated. These alternatives will have some unavoidable impact on vehicular and pedestrian safety.

Increased Energy Use to Transport Wastewater

The Mt. Vernon force main alternative will cause an unavoidable increase in energy use.

Bluff Alternatives

Aesthetic Values

Incorporation of a mitigative strategy which creates visual barriers to the construction corridor and revegetation of disturbed areas will eliminate most of these impacts. These alternatives will have some unavoidable temporary adverse impact on the aesthetic value of the area.

Disruption of the Semi-Natural Area and Its Associated Wildlife

If construction areas are replanted with plants which will serve as wildlife food and protective cover, most of this impact will be reduced or eliminated. The decrease in tree density and loss of mature trees is, however, an unavoidable impact.

Increased Stream Erosion

Implementation of a site-specific erosion and sediment pollution control plan will greatly reduce impacts during construction. Gabions and riprap at creek crossings will produce a post-construction beneficial impact.

Public Inconvenience

An unavoidable impact will exist during times when construction activities are directly in line with access points. During other times, the mitigative measures described in Chapter IV will essentially eliminate this impact.

Public Safety

Although mitigative measures as described in Chapter IV can be employed to reduce the impact of construction on public safety, this impact cannot be completely avoided.

Increased Energy Use to Transport Wastewater

There will be an unavoidable impact on energy use with the Bluff force main alternative.

CHAPTER VI: RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Nearly all the previously described impacts associated with the alternatives under consideration will result from short-term (construction-phase) use of the environment. Long-term impacts (operational-phase) of these alternatives are those associated with any intrusion into wooded areas. While in the short-term, any intrusion may result in a decrease in the aesthetic and the biological value of the wooded area, this decrease in value will become less severe with each growing season. As such, there is no permanent long-term loss of productivity or environmental quality.

The short-term use of the area for construction will provide a long-term solution to the present problem of sewage backup into various basements in the basin from hydraulic overloading of the Dry Creek interceptor.

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CHAPTER VII: STEPS TAKEN TO MINIMIZE HARM TO THE ENVIRONMENT

Mitigative strategies are available for most of the impacts associated with these alternatives. Strategies such as requiring a site-specific erosion and sediment pollution control plan, requiring a revegetation plan for disturbed areas, and prohibiting open excavation during non-working hours will be used to minimize harm to the environment. To ensure that these strategies are carried out they will be made a condition to any EPA grant for construction.

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CHAPTER VIII: IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Resources such as material, manpower, capital, and energy required for the construction and operation of all feasible alternatives considered in this report are irreversible and irretrievable. These alternatives will not result in the permanent removal of any land from its present use since no above-ground structures are required for any of the alternatives.

While a decrease in tree density and loss of aesthetic value will extend beyond the construction stage, the resource value of the Dry Creek area will not be permanently lost. Within the operational phase of these alternatives, the natural setting of the area will return.

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CHAPTER IX: SUMMARY AND EVALUATION OF ALTERNATIVES AND THEIR IMPACTS

The purpose of this chapter is to provide a brief review of the alternatives and impacts considered for this project so that a concise comparative evaluation of alternatives can be made. Table IV summarizes the important aspects for the alternatives under consideration.

Alternatives comparison must also consider the variation in relative severity and duration of an impact. Impacts may be generally grouped in four classes:

Class I: Impacts which are adverse for a limited time (construction phase), but decrease in severity with longer periods of time. The end result is a return to ambient condition of the study area.

Class II: Impacts which are adverse for a period of time following construction but ulitimately allow a return to ambient condition.

Class III: Impacts which are adverse during construction and for a period of time following construction, but result in a long-term beneficial impact.

Class IV: Impacts which remain adverse indefinitely.

These classes of impacts are presented on the following graphs. Relative time is shown by the horizontal axis, and relative intensity of the impact by the vertical axis.

Each impact identified for this project is so represented along with a brief narrative description.

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Table IV: Summarization of Impacts

Impacts	Alternatives		
	Dry Creek	Mt. Vernon	Bluff
Cost (Present Worth)	$ 735,682	$1,398,723 Mt. Vernon Gravity $1,503,786 Mt. Vernon Force Main	$ 881,718 Bluff Gravity $1,160,108 Bluff Force Main
Noise	Increase during construction	Increase during construction	Increase during construction
Aesthetics	Damage due to 1.92 acres construction corridor. Damage not irreversible but extends beyond construction period.	Possibility of some damage but an area less than 0.1 acres.	Damage due to 0.32 acres construction corridor. Damage not irreversible but extends beyond construction period.
Disruption of Natural Environment	Damage due to removal of 133 mature trees (4 inches in diameter), and change from a mature woodland habitat to an immature woodland.	Possibility of some damage to an area less than 0.1 acres.	Damage due to removal of 118 mature trees and change from a mature woodland habitat to an immature woodland.
Stream Bank Erosion	Excavation required for 5 creek crossings.	No excavation required for creek crossings but possibility of infringement on creek banks.	Excavation required for 2 creek crossings.

Table IV: Summarization of Impacts
(Cont.)

Impacts	Alternatives		
	Dry Creek	Mt. Vernon	Bluff
Public Inconvenience	7 accesses will be temporarily blocked.	64 accesses will be temporarily blocked.	15 accesses will be temporarily blocked.
Public Safety	Construction in an area generally remote to pedestrian and vehicular traffic.	Construction located within an arterial street.	Construction located in a residential street.
Energy Use to Transport Wastewater		(Force main alternative) Annual energy use equivalent to 57 homes (514,400 kilowatts).	(Force main alternative) Annual energy use equivalent to 21 homes (191,000 kilowatts).

Noise (Class I)

Increased noise will be an adverse impact only during construction.

Disruption of Natural Area and Its Associated Wildlife (Class III)

Although removal of trees will result in an immediate adverse impact, the mitigative strategy of revegetation with plants of value to wildlife will provide a long-term beneficial impact.

Stream Bank Erosion (Class III)

During construction increased erosion is an adverse impact. Bank stabilization at creek excavation will assist future erosion at these locations and provide a long-term beneficial impact.

Aesthetic Values (Class II)

The initial removal of vegetation will cause adverse impact on aesthetic values. However, as planting required as a mitigative

strategy matures this impact will be reduced in severity until preconstruction conditions are reached.

Public Safety (Class I)

With the completion of construction there will be no adverse impact.

Public Inconvenience (Class I)

Inconvenience to local residents would be limited to construction periods.

Energy Use to Transport Wastewater (Class IV)

With the completion of construction and placement of the pumping station in service there would be an adverse impact on energy consumption for the life of the project.

Alternatives can be evaluated and ranked based on consideration of both the summarization of the alternative and the relative intensity and duration of the impacts.

Using this information, each impact except cost, for an alternative can be assigned a value of 1 (minor impact, 2 (moderate

impact), or 3 (major impact). Cost impacts, in which accurate values are known can be ranked for 1 for lowest to 5 for highest cost.

Table V presents the ranking of alternatives along with a brief explanation of the rationale used in the ranking process.

Table V: Evaluation of Alternatives: Ranking and Rationale

Impacts	Alternatives				
	Dry Creek	Mt. Vernon Gravity	Mt. Vernon Force Main	Bluff Gravity	Bluff Force Main
Noise	(2) impact of limited duration.	(2) impact of limited duration.	(2) impact of limited duration.	(2) impact of limited duration.	(2) impact of limited duration.
Aesthetics	(3) impact moderated by mitigation and relative duration.	(1) limited intrusion.	(1) limited intrusion.	(2) impact moderated by mitigation and relative duration.	(2) impact moderated by mitigation and relative duration.
Wildlife	(3) severe in short-term but long-term benefits.	(1) limited intrusion.	(1) limited intrusion.	(2) severe in short-term but long-term benefits.	(2) severe in short-term but long-term benefits.
Erosion	(2) permanent stabilization at 5 creek crossings offset temporary erosion.	(1) limited intrusion but no long-term improvements.	(1) limited intrusion but no long-term improvements.	(2) permanent stabilization at 2 creek crossings offset temporary erosion.	(2) permanent stabilization at 2 creek crossings offset temporary erosion.
Public Safety	(2) construction in a remote area.	(3) construction in arterial street and residential area.	(3) construction in arterial street and residential area.	(2) construction in residential area and street.	(2) construction in residential area and street.

Table V: Evaluation of Alternatives: Ranking and Rationale

Impacts	Alternatives				
	Dry Creek	Mt. Vernon Gravity	Mt. Vernon Force Main	Bluff Gravity	Bluff Force Main
Noise	(2) impact of limited duration.	(2) impact of limited duration.	(2) impact of limited duration.	(2) impact of limited duration.	(2) impact of limited duration.
Aesthetics	(3) impact moderated by mitigation and relative duration.	(1) limited intrusion.	(1) limited intrusion.	(2) impact moderated by mitigation and relative duration.	(2) impact moderated by mitigation and relative duration.
Wildlife	(3) severe in short-term but long-term benefits.	(1) limited intrusion.	(1) limited intrusion.	(2) severe in short-term but long-term benefits.	(2) severe in short-term but long-term benefits.
Erosion	(2) permanent stabilization at 5 creek crossings offset temporary erosion.	(1) limited intrusion but no long-term improvements.	(1) limited intrusion but no long-term improvements.	(2) permanent stabilization at 2 creek crossings offset temporary erosion.	(2) permanent stabilization at 2 creek crossings offset temporary erosion.
Public Safety	(2) construction in a remote area.	(3) construction in arterial street and residential area.	(3) construction in arterial street and residential area.	(2) construction in residential area and street.	(2) construction in residential area and street.

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APPENDIX I

FLORA AND FAUNA OF IMPACT AREA

TREES AND SHRUBS

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
American Elm	Ulmus americana	0
Siberian Elm	Ulmus pumila	0
Red Elm	Ulmus rubra	0
Austrian Pine	Pinus nigra	0
Silver Maple	Acer saccharinum	0
Black Walnut	Juglans nigra	0
Tree of Heaven	Ailanthus altissima	0
Black Locust	Robinia pseudoacacia	0
Russian Olive	Elaeagnus angustifolia	0
Osage Orange	Maclura pomifera	0
Rough-leaved Dogwood	Cornus drummondii	0
Kentucky Coffee Tree	Gymnocladus dioica	0
Panicled Goldenrain Tree	Koelreuteria paniculata	0
Soapberry	Sapindus drummondii	0
Hackberry	Celtis occidentalis	0

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Willow	Salix sp.	0
Red Cedar	Juniperus virginiana	0
Redbud	Cercis canadensis	0
Cottonwood	Populus deltoides	0
Mulberry	Morus sp.	0
Box Elder	Acer negundo	0
Green Ash	Fraxinus pennsylvanica	0
Catalpa	Catalpa speciosa	0
Bur Oak	Quercus macrcarpa	0
Thornless Locust	Robinia sp.	0
Shrub Althea	Hibiscus syriacus	0
Poison Ivy	Rhus radicans var. vulgaris	0
Bristly Greenbrier	Smilax hispida	0
Raccoon Grape	Ampelopsis cordata	0
Riverbank Grape	Vitis riparia	0
Virginia Creeper	Parthenocissus quinquefolia	0
Wahoo	Euonymus atropurpurea	0

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Golden Current	Ribes odoratum	O
Bush Honeysuckle	Lonicera sp.	O
Multiflora Rose	Rosa multiflora	O
European Privet	Ligustrum vulgare	O
Smooth Sumac	Rhus glabra	O
Coralberry-Buckbrush	Symphoricarpos occidentalis	O
FISH		
Green Sunfish	Lepomis cyanellus	O
Black Bullhead	Ictalurua melas	O
Red Shiner	Notropis lutrensis	O
Fathead Minnow	Pimephales promuelas	P
REPTILES AND AMPHIBIANS		
Bullfrog	Rana catesbeiana	O
Leopard Frog	Rana pipieus	O
Northern Cricket Frog	Acris crepitans	O
Western Narrow-Mouth Frog	Gastrophryne olivalea	P
Rocky Mountain Toad	Bufo woodhousei	P
Snapping Turtle	Chelydra serpentina	P

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Eastern Ornate Box Turtle	Terrapena ornata	P
Red-Side Garter Snake	Thamnphiss sirtalis	P
Bull Snake	Pituophis melanoleucus	P
Black Rat Snake	Elaphe obsoleta	P
Lined Snake	Tropidoclonion lineatum	P
Northern Water Snake		P
MAMMALS		
Short-tailed Shrew	Blarina breyicauda	P
Opossum	Didelphus marsupialis	P
Eastern Mole	Scalopus aquaticus	P
Red Bat	Lasiurus borealis	P
Eastern Cottontail	Sylvilagus floridanus	O
Fox Squirrel	Sciurus niger	O
Woods Mouse	Peromyscus leucopus	P
Eastern Woodrat	Neotoma floridana	P
Muskrat	Ondatra zibethicus	O
House Mouse	Mus musculus	P
Red Fox	Vulpes fulva	P
Raccoon	Procyon lotor	P

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Striped Skunk	Mephitis mephitis	P
White-tailed Deer	Odocoileus virginianus	P
BIRDS		
Great Blue Heron	Ardea heroblia	O
Green Heron	Butorides virescens	O-N
Great Egret	Casmerodius albus	O
Black-Crowned Night Heron	Nyctiloray nyeticuaray	O
Yellow-Crowned Night Heron	Nyctanassa violacea	O-N
Mallard Duck	Anas platyrhyncuos	O-N
Wood Duck	Aix sponsa	P
Mandarin Duck		O-N
Common Flicker (Red-Shafted)	Colaptes cafer	O-N
Common Flicker (Yellow-Shafted)	Colaptes auratus	O
Red-Bellied Woodpecker	Centurus carolinus	O-N
Red-Headed Woodpecker	Melanerpes erythrocephalus	O-N
Yellow-Bellied Sapsucker	Sphyrapicus varius	O
Hairy Woodpecker	Dendrocopus villosus	O-N
Downy Woodpecker	Dendrocupus pubescens	O-N
Eastern Kingbird	Tyrannus tyrannus	O-N

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Western Kingbird	Tyrannus verticalis	O-N
Scissor-Tailed Flycatcher	Muscivora furfigata	O-N
Great Crested Flycatcher	Muscivora crinitus	O-N
Eastern Phoebe	Sayornis phoere	O-N
Yellow-Bellied Flycatcher	Empidonax elavinentris	O
Acadian Flycatcher	Empidonax virescens	O-N
Willow Flycatcher	Empidonax traillii	P
Least Flycatcher	Empidonax minimus	P
Eastern Wood Pewee	Contopus virens	P-N
Olive-Sided Flycatcher	Nuttallornis borealis	P
Unidentified Flycatcher	Empidonax sp.	O
Barn Swallow	Hirundo rustica	O-N
Purple Martin	Progne suris	O-N
Blue Jay	Cyanocitta cristata	O-N
Common Crow	Corvus brachyrhynchos	O-N
Black-Capped Chickadee	Parus atricapillus	O-N
Tufted Titmouse	Parus bicolor	O-N
Mississippi Kite	Ictinia misisippiensis	O-N
Sharp-Shinned Hawk	Accipiter striatus	P

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Red Tailed Hawk	Buteo jamaicensis	O
Rough-Legged Hawk	Buteo lagopus	O
Prairie Falcon	Falc mexicanus	O
White-Breasted Nuthatch	Sitta carolinensis	O-N
Red-Breasted Nuthatch	Sitta canadensis	O
Brown Creeper	Certhia familiaris	O
House Wren	Troglodytes aedon	O-N
Winter Wren	Troglodytes troglodytes	P
Bewick's Wren	Tyryomanes bewickii	P-N
Carolina Wren	Thryothorus ludovicianus	O-N
Mockingbird	Mimus polyglottos	O-N
Gray Catbird	Dumetella carolinensis	O-N
Brown Thrasher	Toxostoma rufum	O-N
Robin	Turdus migratorius	O-N
Wood Thrush	Hylocichla mustelina	O
Hermit Thrush	Hylocichla guttata	O
Swainson's Thrush	Hylocichla ustulata	O
Gray-Cheeked Thrush	Hylocichla miuima	O
Veery	Hylocichla fusceslens	O

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Western Bluebird	Sialia sialis	O-N
Townsend's Solitaire	Myadestes townsendi	O
Blue-Gray Gnatcatcher	Polioptila caerulea	P-N
Golden-Crowned Kinglet	Regulus satrapa	P
Ruby-Crowned Kinglet	Regulus calendula	O
Cedar Waxwing	Bombycilla cedrorum	O
Starling	Sturnus vulgaris	O-N
Bobwhite	Colinus virgianus	O-N
Ring-Necked Pheasent	Phasianus colchicus	O
[1]Sandhill Crane	Grus cavadensis	O
Virginia Rail	Rallus limicula	O
American Woodcock	Philohela minor	P
Spotted Sandpiper	Actitis macularia	P
Bell's Vireo	Vireo bellii	P-N
Solitary Vireo		P
Red-Eyed Vireo	Vireo olivaceus	O-N
Philadelphia Vireo	Vireo philadelphicus	P
Warbling Vireo	Vireo gilvus	O-N

1. Dead when observed.

COMMON NAME	SCIENTIFIC NAME	OCCURANCE*
Yellow-Throated Vireo	Vireo flavifrons	O
Black and White Warbler	Mniotilta varia	P
Tennessee Warbler	Vermivora peregina	O
Orange-Crowned Warbler	Vermivora celata	O
Yellow Warbler	Dendroica petechia	O-N
Magnolia Warbler	Dendroica magnolia	O
Cape May Warbler	Dendroica tigrina	O
Myrtle Warbler	Dendroica coronata	O
Audubon's Warbler	Dendroica auduboui	O
Black-Throated Green Warbler	Dendroica virens	P
Blackburnian Warbler	Dendroica fusca	P
Chestnut-Sided Warbler	Dendroica pensylvanica	P
Blackpoll Warbler	Dendroica striata	O
Palm Warbler	Dendroica palmarum	P
Ovenbird	Seiurus aurocapillus	P
Northern Waterthrush	Seiurus noveboralensis	P
Louisiana Waterthrush	Seiurus motalilla	P
Mourning Warbler	Opororuis philadelphia	O-N

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
MacGilliuray's Warbler	Opurornis tolmiei	P
Common Yellow Throat	Geothlypis trichas	P
Yellow-Breasted Chat	Icteria virens	P
Wilson's Warbler	Wilsonia pusilla	O
American Redstart	Setophaga ruticilla	P
Worm-Eating Warbler	Helmitheros vermivorus	O
Connecticut Warbler	Oporornis agilis	O
House Sparrow	Passer domesticus	O-N
Eastern Meadowlark	Sturnella magna	P-N
Western Meadowlark	Sturnella neglecta	O
Red-Winged Blackbird	Agelaius phoeniceus	O-N
Orchard Oriole	Icterus spurius	O-N
Baltimore Oriole	Icterus galbula	O-N
Rusty Blackbird	Euphagus carolinus	O
Brewer's Blackbird	Euphagus cyanocephalus	P
Common Grackle	Quiscalus guiscula	O-N
Brown-Headed Cowbird	Molothrus ater	O-N
Franklin's Gull	Larus pipiycan	O
Rock Dove	Columba livia	O-N

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Mourning Dove	Zenaidura malroura	O-N
Yellow-Billed Cuckoo	Coccyzus americanus	O-N
Black-Billed Cuckoo	Coccyzus elythrophthalmus	P
Screech Owl	Otus asio	O-N
Great Horned Owl	Bubo virginianus	O
Saw-Whet Owl	Aegolius acadica	P
Common Nighthawk	Chordeiles minor	O-N
Chimney Swift	Chaetura pelagica	O-N
Ruby-Throated Hummingbird	Archilochus colubris	O-N
Belted Kingfisher	Megaceryle alcyon	P
Scarlet Tanager	Piranga olivalea	P
Summer Tanager	Piranga rubra	P
Cardinal	Richmondena cardinalis	O-N
Rose-Breasted Grosbeak	Pheucticus ludovicianus	O-N
Indigo Bunting	Passerina cyanea	P
Purple Finch	Carpodalus purpureus	O
Pine Siskin	Spinus pinus	O
American Goldfinch	Spinus tristis	O-N
Red Crossbill	Loxia curvirostra	O

COMMON NAME	SCIENTIFIC NAME	OCCURANCE *
Rufous-Sided Towhee	Pipilo erythrophthalmus	O
Vesper Sparrow	Pooeletes gramineus	O
Slate-Colored Junco	Junco hyemalis	O
Oregon Junco	Junco oreganus	O
Tree Sparrow	Spizella arborea	O
Chipping Sparrow	Spizella passerina	O
Clay-Colored Sparrow	Spizella pallida	O
Harris Sparrow	Zonotrichia querula	O
White-Crowned Sparrow	Zonotrichia leucophrys	O
White-Throated Sparrow	Zonotrichia albicollis	O
Fox Sparrow	Passerella iliaca	P
Lincoln's Sparrow	Melospiza linculnii	O
Swamp Sparrow	Melospiza georgiana	P
Song Sparrow	Melospiza melodia	O

* O=OBSERVED N=NESTING SPECIES P=HABITATE AVAILABLE POSSIBLE OCCURENCE

APPENDIX II

Capital Cost and Present Worth of Alternatives

Evaluation and criteria for the costs of the alternatives are based on 1978 cost estimates derived from local contractors and suppliers, bid prices of similar Region VII projects, and engineering estimates.

Useful life and salvage value of project components and method for cost effective analysis were determined from Appendix A of 40 CFR part 35, Grants for Construction of Treatment Works. An interest (discount) rate of 7 percent was used for analysis.

Unit Terms Used in Following Tables

LF - Linear Feet
EC - Each
SY - Square Yards
CY - Cubic Yards
SF - Square Feet
LS - Lump Sum

DRY CREEK: TOTAL ESTIMATED CAPITAL COST AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
1500	LF	36" CRP-PVC Lined Class III	$ 140/LF	$210,000	$105,000
204	LF	36" CRP-PVC Lined Class IV	150/LF	30,600	15,300
1230	LF	24" VCP Pipe	90/LF	110,700	55,350
1	EC	Siphon	40,000/EC	40,000	20,000
263	LF	10" PVC Pipe	20/LF	5,260	0
251	LF	8" PVC Pipe	17/LF	4,267	0
5	EC	4' diameter manholes	2,000/EL	10,000	0
6	EC	5' diameter manholes	2,500/EC	15,000	0
11	EC	Special manholes	4,500/EL	49,500	0
4	EC	Abandon manholes	200/EC	800	0
1	EC	Remove manholes	500/EC	500	0
4	EC	Modified manholes	500/EC	2,000	0
1700	LF	Abandon existing line	7/LF	11,900	0
220	LF	36" Pipe Encasement	75/LF	16,500	0
40	LF	Pipe Encasement	50/LF	2,000	0

DRY CREEK: TOTAL ESTIMATED CAPITAL COST AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
365	SY	Pavement removed and replaced	$ 30/SY	$ 10,950	$ 0
85	SY	Driveway removed and replaced	25/SY	2,125	0
5	EC	Creek Crossing	5,000/EC	25,000	0
760	CY	Gabions	75/CY	57,000	0
400	SY	Riprap	50/SY	20,000	0
160	SF	Sidewalk removed and replaced	10/SF	1,600	0
	LS	Site Clearing	16,500/LS	16,500	0
	LS	Site Restoration	21,500/LS	21,500	0
				$663,702	$195,650

Construction Cost	$663,702	
Design Cost	48,500	
Contingencies	66,370	
Interest during construction	7,665	
Total Capital Cost	$786,237	Total Salvage $195,650

MT. VERNON GRAVITY: TOTAL ESTIMATED CAPITAL COST
AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
5080	LF	36" CRP-PVC Lined class III	$ 140/LF	$711,200	$355,600
1500	LF	36" CRP-PVC Lined class IV	150/LF	225,000	112,500
18	EC	Special Manholes	4,500/EL	81,000	0
6090	SY	Pavement removed and replaced	30/SY	182,700	0
1700	LF	10" Slipliner	35/LF	59,500	0
8	EC	Modified Manholes	500/EC	4,000	0
				$1,263,400	$468,100

Construction Cost	$1,263,400		
Design Cost	70,500		
Contingencies	106,090		
Interest during construction	31,190		
Original design cost	48,500		
Total Capital Cost	$1,519,680	Total Salvage	$468,100

MT. VERNON FORCE MAIN: TOTAL ESTIMATED CAPITAL COST
AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
6580	LF	20" CIP Force Main	$ 60/LF	$ 394,800	$197,400
1	EC	8800 GPM Pump Station	400,000/EC	400,000	0
6090	SY	Pavement removed and replacement	30/SY	182,700	0
1700	LF	10" Slipliner	35/LF	59,500	0
8	EC	Modified Manholes	500/EC	4,000	0
				$1,041,000	$197,400

Construction Cost	$1,041,000
Design Cost	70,500
Contingencies	104,100
Interest during construction	18,217
Original design cost	48,500
Total Capital Cost	$1,282,317

Total Salvage $197,400

BLUFF GRAVITY: TOTAL ESTIMATED CAPITAL COST
AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
735	LF	36" CRP-PVC Liner class III	$ 140/LF	$102,900	$ 51,450
1600	LF	36" CRP-PVC Liner class IV	150/LF	240,000	120,000
1230	LF	24" PVC Pipe	90/LF	110,700	55,350
1	EC	Siphon	40,000/EL	40,000	20,000
1700	LF	10" Slipliner	35/LF	59,500	0
7	EL	4' Diameter manholes	2,000/EC	14,000	0
4	EC	5' Diameter manholes	2,500/EC	10,000	0
8	EC	Modified manholes	500/EC	4,000	0
13	EC	Special manholes	4,500/EC	58,500	0
1783	SY	Pavement removed and replaced	30/SY	53,490	0
160	SF	Sidewalk removed and replaced	10/SF	1,600	0
100	LF	36" Pipe Encasement	75/LF	7,500	0

BLUFF GRAVITY: TOTAL ESTIMATED CAPITAL COST
AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
300	CY	Gabions	$ 75/CY	$ 22,500	$ 0
150	SY	Riprap	50/SY	7,500	0
2	EC	Creek crossings	5,000/EC	10,000	0
	LS	Site clearing	LS	5,750	0
	LS	Site restoration	LS	7,150	0
				$755,090	$246,800

Construction Cost	$ 755,090
Design Cost	54,500
Contingencies	75,509
Interest during construction	11,892
Original design cost	48,500
Total Capital Cost	$945,491

Total Salvage $246,800

BLUFF FORCE MAIN: TOTAL ESTIMATED CAPITAL COST
AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
2350	LF	20" CIP Force Main	$ 60/LF	$141,000	$ 70,500
1	EC	8800 GPM Pump Station	400,000/LF	400,000	0
1230	LF	24" LCP Pipe	90/LF	110,700	55,350
1	EC	Siphon	40,000/EC	40,000	20,000
1700	LF	10" Slipliner	35/LF	59,500	0
100	LF	Pipe Encasement	75/LF	7,500	0
8	EL	Modified Manholes	500/EL	4,000	0
4	EL	5' Diameter manholes	2,500/EL	10,000	0
3	EL	4' Diameter manholes	2,000/EL	6,000	0
1783	SY	Pavement removal and replacement	30/SY	53,490	0
160	SF	Sidewalk removal and replacement	10/SF	1,600	0
2	EC	Creek crossings	5,000/EC	10,000	0
300	CY	Gabions	75/CY	22,500	0

BLUFF FORCE MAIN: TOTAL ESTIMATED CAPITAL COST
AND SALVAGE VALUE

Quantity	Unit	Item	Unit Cost	Total	Salvage
150	SY	Riprap	$ 50/SY	$ 7,500	$ 0
	LS	Site Clearing	LS	5,750	0
	LS	Site Restoration	LS	7,150	0
				$886,690	$145,850

Construction Cost	$ 886,690	
Design Cost	62,500	
Contingencies	88,689	
Interest during construction	10,241	
Original design cost	48,500	
Total Capital Cost	$1,069,620	Total Salvage $145,850

COST EFFECTIVE ANALYSIS

(7% INTEREST)

Cost	Interest Factor	Dry Creek	Mt. Vernon Gravity	Mt. Vernon Force Main	Bluff Gravity	Bluff Force Main
Capital Cost	1.00	786,237	1,519,680	1,282,317	945,491	1,069,62(
Operation and Maintenance	10.594	0	0	272,477	0	101,17:
Salvage Value	0.2584	-50,555	-120,957	-51,008	-63,773	-37,684
Total Present Worth		735,682	1,398,723	1,503,786	881,718	1,160,108